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UNIVERSITY OF ALBERTA

INTRINSIC MOTIVATION REVISITED

BY

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JUDY CAMERON

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

DEPARTMENT OF EDUCATIONAL PSYCHOLOGY

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Dedication

To the memory of my brother Peter.

Abstract

Over the past two decades, there has been a growing literature that has assessed the impact of rewards/reinforcement on intrinsic motivation. A major contention is that rewards/reinforcement negatively impact a person's intrinsic motivation. The view is that if people receive a reward for engaging in an already enjoyable activity, they will like the task less and participate less than they originally did, once the reward is withdrawn. The objective of this dissertation was to evaluate the literature on the effects of reward/reinforcement on intrinsic motivation by a narrative review, a meta-analysis, and a socio-historic review.

An examination of the literature suggests that results from studies investigating the effects of rewards/reinforcement on intrinsic motivation are conflicting. Only a few studies have been conducted in which the rewards used are shown to be reinforcers. Results of such studies indicate that reinforcement does not decrease a person's intrinsic motivation. The majority of studies have evaluated the effects of 'reward' on intrinsic motivation. Findings from these studies are not clear cut; some show a negative effect, others show a positive effect; others find no differences.

Results from the meta-analysis indicate that overall, reward does not decrease intrinsic motivation. Verbal praise produces a slight increase in intrinsic motivation as measured by attitude and time spent on a task. Tangible rewards do not affect intrinsic motivation when they are received unexpectedly or when they are expected and contingent on some level of performance. The only negative effect appears when rewards are promised (expected), not contingent on performance, and tangible. Under this condition, there is a minimal negative effect on intrinsic motivation as measured by time on task. The same condition produces no effect on subjects' attitudes.

Although the results indicate that reinforcement is not harmful, and that reward is detrimental only under a highly specified set of circumstances, the view that reinforcement/reward decreases intrinsic motivation has been widely accepted in

education, business, and psychology, in general. One possible reason for this interpretation is that the studies on intrinsic motivation were initiated at a time when behavioral views were under attack.

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I. Introduction

Reinforcement theory has had a significant impact on education. Professors in faculties and departments of education routinely teach the basic elements of behavior theory. As a consequence, most classroom teachers have at least some rudimentary understanding of the principles of reinforcement. These principles are often used to promote learning and to motivate students. In recent years, however, there has been a growing concern over the application of reward systems in educational settings. Several researchers have presented evidence and argued that incentive systems based on reinforcement may have detrimental effects. The contention is that reinforcement may decrease an individual's intrinsic motivation to engage in a particular activity. To illustrate, if a child who enjoys reading is externally reinforced (e.g., with money) for reading, the child may come to read less once the reward is discontinued. In other words, one alleged effect of reinforcement is that it undermines intrinsic interest in a task.

The literature concerned with the effects of reinforcement on intrinsic motivation draws mainly from experimental investigations. In an article published in the *American Psychologist,* a prominent and influential psychological journal, Schwartz (1990) examined that evidence and stated that "... reinforcement has two effects. First, predictably it gains control of [an] activity, increasing its frequency. Second,... when reinforcement is later withdrawn, people engage in the activity even less than they did before reinforcement was introduced" (p. 10). Schwartz provided an example from an experiment conducted by Lepper, Greene and Nisbett (1973). In this study, a group of nursery school children was given a reward for drawing with felt-tipped pens. Schwartz noted that a week after the experimental session, those children who had previously received rewards for drawing were less likely to draw pictures than those who had not received a reward. Moreover, if they did draw, their pictures were judged

to be less creative. Schwartz suggested that prior to the reinforcement procedure "something else was influencing the drawing and that other influence was suppressed or superseded by the reinforcement contingency" (p.11). He further added that "Clearly, this laboratory demonstration is an example of how value can be destroyed" (p.11). Schwartz's view is not uncommon. A cursory survey of introductory psychology textbooks will convince most readers that the "something else" Schwartz refers to is an individual's intrinsic motivation and that this motivation is decreased by reinforcement contingencies. It appears that this view is taken to be a well established fact or, at least, not seriously questioned by many psychologists and educators.

The purpose of this dissertation is to review and evaluate the literature and experimental results concerned with the effects of reinforcement on intrinsic motivation. The literature is examined in a variety of ways: by a traditional literature review, by a meta-analysis of the relevant experimental investigations, and by a discussion of the literature from a socio-historic perspective.

The second chapter which follows this introduction is a narrative review of the literature. Key concepts and terms are defined, and the major studies dealing with the effects of rewards on intrinsic interest are described and evaluated. Various research designs and procedures used to investigate the phenomenon are outlined and theoretical accounts of the findings are discussed.

Chapter three presents a quantitative analysis of the effects of rewards on intrinsic motivation. A common criticism of narrative literature reviews is that the reviewer selects the important studies and this selection is based on the reviewer's own biases and impressions (for a discussion of this issue, see Light & Pillemer, 1984). Several researchers have suggested that one way around this problem is to statistically analyze all studies dealing with the topic, an approach known as meta-analysis. Meta-analysis, a technique first proposed by Glass (1976), involves using statistical procedures to combine findings from a large number of studies. A description of meta-

analysis procedures and results from the present meta-analysis are reported in Chapter three.

In the fourth chapter, the literature on intrinsic motivation is analyzed from a social and historical perspective. This entailed examining the context in which the research questions were generated and the findings were interpreted. An attempt is made to outline the prevailing views in psychology at the time the research was initiated. This historical review should make it apparent that research questions asked and the interpretations and applications of research cannot be divorced from their socio-historic context.

II. A Narrative Review of the Literature

A Brief History of Motivation

Psychologists have long been interested in the concept of motivation. 'Motivation' comes from the Latin word 'motere' meaning 'to move' and is generally understood as that which instigates behavior, directs it and accounts for its cessation.

In the early part of this century, much human and animal motivation was assumed to be biologically determined; 'instinct' was a major explanatory concept. The idea was that birds migrate in the winter because they have an instinct to do so, women take care of their children because of a maternal instinct, and men fight because they have aggressive instincts. While some psychologists sought to understand a limited number of instincts, others (e.g., McDougall, 1908) developed long lists of human instincts including gregariousness, repulsion, self-assertion, flight, and so on to account for behavior. As the lists grew longer and they began to include such things as an "instinct to avoid eating apples in one's own orchard", psychologists began to question the explanatory usefulness of instinct theory. They suggested that to simply add a new instinct to the growing list of behavior was in no way an explanation of behavior. In addition, a few experimenters conducted studies that demonstrated that many important behaviors thought to be instinctive, were learned (e.g., Kuo, 1931). Today, there is a recognition that behavior occurs in an environmental context. For this reason 'instinct' has been replaced with new terms such as 'species-specific behavior', 'innate', and 'fixed action patterns'. Contemporary psychologists are interested in studying the interaction of organismic and environmental factors.

Later theories of motivation, specifically Hull's drive reduction theory and Freud's psychoanalytic theory, emphasized the role of tension reduction in motivation. In both of these accounts, the view is that people are driven to activities that bring satisfaction through reduction of tension. In other words, the organism is in a state of

disequilibrium (e.g., hungry or angry) and attempts to establish homeostasis (e.g., by eating or by expressing anger). Although these theories continue to serve as the cornerstone for much of our thinking about motivation, a few researchers have identified motives that cannot easily be subsumed under these theories.

The idea that all motives are derived from homeostatic imbalance was challenged in the 1950's. A number of studies provided evidence for human and animal motives such as exploration (Butler, 1953), curiosity (Berlyne, 1950), activity (Hill, 1956) and manipulation (Harlow, Harlow & Meyer, 1950). While some attempt was made to account for these motives within a drive theory framework, a general discontent with drive theory led to a re-examination of the basic concepts in the field of motivation.

In a classic review article, White (1959) argued that exploration, manipulation, etc. could not be shown to have the same functional properties as drives such as hunger, thirst and sex and therefore could not be adequately conceptualized in terms of primary drives. Instead, White suggested that manipulation of surroundings and exploratory behavior form part of a process (labeled 'competence') whereby an animal or person learns to deal effectively with the environment. According to White, activities that are performed in the service of competence cannot be fully acquired through behavior instigated by drives and must be motivated in their own right. White proposed the concept of "effectance motivation" to account for such behaviors. Effectance motivation aims for feelings of efficacy and leads an organism to find out how the environment can be changed and what consequences follow from these changes.

Effectance motivation does not imply that new motives replace the homeostatic ones. Instead, a widely held view is that much day to day activity is motivated by energy intrinsic to the organism. This motivation is not rewarded by tension or

stimulus reduction. Today the term "intrinsic motivation" is used by many psychologists to refer to non-drive based motivation (e.g., Deci & Ryan, 1985).

Intrinsic Motivation

Intrinsic motivation has been proposed as an explanation for behavior caused by a need to be effective in dealing with the environment (White, 1959), a need for achievement (McLelland, Atkinson, Clark & Lowell, 1953), a need to be a causal agent (deCharms, 1968) a need for mastery, and a need to be competent and self-determining (Deci, 1975; Deci & Ryan, 1985). In each of these instances, behavior for which there is no apparent external control is believed to be intrinsically motivated.

Several researchers draw a distinction between intrinsic and extrinsic motivation. Intrinsically motivated behaviors are ones for which there is no apparent reward except the activity itself (Deci, 1975). Extrinsically motivated behaviors, on the other hand, refer to behaviors in which an external controlling variable can be readily identified. To quote Zimmerman (1985): "'Intrinsic motivation' [is] thus defined by default: performance in the absence of external rewards" (p. 118). In a recent text on human motivation, Franken (1988) provides an example to clarify the intrinsic/extrinsic distinction:

> "A child who does well in school simply to gain approval from his parents or to acquire a skill is engaging in the activity for extrinsic reasons (rewards). If however, he finds the activity motivating even in the absence of approval or some other form of gain, then we say that he is engaging in the activity for intrinsic reasons (rewards)" (p.31).

According to Deci (1975), intrinsic motivation is demonstrated when people engage in an activity for its own sake and not because of any extrinsic reward. The result of such behavior is an experience of interest and enjoyment, people feel competent and self-determining, and they perceive the locus of causality for their behavior to be internal. Intrinsically motivated behavior is seen to be innate and is said to result in greater creativity, flexibility, and spontaneity (Deci & Ryan, 1985). In

contrast, extrinsically motivated actions are characterized by pressure and tension and result in low self-esteem and anxiety (Deci & Ryan, 1985). From this perspective, intrinsic motivation is regarded as superior and is thus, highly valued.

A great deal of debate has surrounded the intrinsic/extrinsic distinction. Several critics (e.g., Bandura, 1977; Dickinson, 1989; Guzzo, 1979; Scott, 1975) point out difficulties in identifying intrinsically motivated behaviors. Although many human behaviors appear to occur in the absence of any obvious or apparent extrinsic consequences, they may, in fact, be due to infrequent rewards. Dickinson (1989) suggests that the more complex the behavior the more difficult it becomes to completely eliminate the possibility of external control. For example, a chess player responds to the rules of the game, the position of the pieces on the board, and covert verbal strategies. This simply describes "playing the game". Any of these elements may be members of response classes that are maintained and strengthened by contingencies of reinforcement. The person may play chess because of a history that has do with games and social reinforcement, a history of winning or losing, and so on. To an outside observer, the chess player may appear to be intrinsically motivated.

From this perspective, intrinsically motivated behavior may simply be behavior for which appropriate controlling stimuli have yet to be specified. If this is the case, labelling activities and behaviors as "intrinsically motivated" is not much different from the instinct naming approach that was prominent in the early 1900's. That is, "intrinsic motivation" may be a way to explain away behavior and it may serve solely to deter further investigations into environmental determinants of much significant human action.

A second difficulty with the intrinsic/extrinsic dichotomy concerns different philosophical and theoretical assumptions. Deci and Ryan (1985) contend that much human behavior originates internally and is not externally controlled by systematic environmental and genetic variables. The implication of this view is that intrinsic

motivation comes from more than phylogeny and ontogeny; intrinsic motivation springs from the organism alone. One must question what springs from what. It seems apparent that humans consist of blood, flesh and bone. They have experiences. To suggest that there is something else steps outside the bounds of logical scientific inquiry and leans toward theology.

In spite of conceptual difficulties with the intrinsic/extrinsic distinction, the dichotomy has made sense to numerous psychologists and educators who frequently use the terms. Researchers, theorists, and practitioners have written a substantial number of articles on the topic. One area that has been the focus of much research concerns the effects of extrinsic rewards/reinforcers on behavior that has been previously maintained by intrinsic motivation.

The Effects of Reward/Reinforcement on Intrinsic Motivation

Originally, intrinsic and extrinsic motivation were seen as independent. Some theorists assumed that intrinsic and extrinsic rewards were additive and combined to increase overall performance and motivation (e.g., Vroom, 1964; Porter & Lawler, 1968). In terms of work, the view was that the highest motivation to perform would occur in a system in which jobs were interesting and challenging and in which the employee was extrinsically rewarded for performance. In 1968, this assumption was challenged by the psychologist deCharms who hypothesized that external reinforcement might interfere with intrinsic motivation. This suggestion led to a surge of interest and numerous researchers set out to test this hypothesis.

The Early Studies

The first laboratory investigations to test the effects of reinforcement on intrinsic motivation were conducted by Deci (1971, 1972a, 1972b). In the first experiment (1971), twenty four college students, fulfilling a course requirement, were presented

with a puzzle-solving task (Soma, a commercial puzzle composed of seven different shapes which can be fitted together to form an infinite variety of configurations). The Soma puzzle was chosen because it was believed that college students would be intrinsically motivated to do it. The study was made up of three one-hour sessions over a three-day period. Twelve subjects were assigned to an experimental group; the other twelve to a control group. During each session, subjects were individually taken to a room and asked to work on the Soma puzzles in order to reproduce various configurations which were drawn on a piece of paper. Four puzzles were presented in a session and subjects were given thirteen minutes to solve each one. In the second session only, experimental subjects were told that they would receive $1.00 for each puzzle solved. Control subjects were offered no money.

In the middle of each session, the experimenter made an excuse to leave the room for 8 minutes. Subjects were told that they could do as they pleased. The puzzles, three magazines, and an ashtray were available in the room. During these eight-minute periods, the experimenter observed the subjects through one-way glass and recorded the time that each subject spent engaged on the Soma task. The amount of time spent on the task during the free periods was taken to be the measure of intrinsic motivation, the dependent variable.

Deci hypothesized that reinforcement (money) would interfere with subsequent intrinsic motivation and that subjects in the experimental group would spend less time on the task in the third session than they had in the first. He suggested that there would be a significant difference between the experimental and control subjects on this measure. Using a one-tailed t test, Deci found the difference between the two groups to be significant at $p < .10$. The rewarded group spent less time on the task than the control group. Although social scientists do not generally accept results at $p > .05$ as significant, Deci (1971) suggested that the data did indeed support the hypothesis: "If a person is engaged in some activity for reasons of intrinsic motivation, and if he begins

to receive the external reward, money, for performing the activity, the degree to which he is intrinsically motivated to perform the activity decreases" (p.108).

Several reviewers have pointed out methodological flaws in Deci's work. The two groups were not compared on the first free time measure to ensure that they were equivalent at the start of the study. In addition, the experimenter was not blind to the conditions which may have influenced the outcome. Deci did not clearly specify how the experimenter objectively determined whether subjects were, in fact, working on the puzzles during the eight minute free choice periods. Further, Deci's use of a one-tailed test is questionable in light of the fact that the area was new and did not favour one direction over another (for a review of these issues, see Calder & Staw, 1975; Scott, 1975).

Despite these criticisms and difficulties, Deci's experiment is often cited as ground-breaking evidence for the negative effects of reinforcement on intrinsic motivation. Deci's study was the first to investigate an issue which was of prime concern to many psychologists. His experiment provided researchers with a way to measure intrinsic motivation and with a paradigm to investigate the effects of various reinforcement contingencies. Flaws detected in the original research led to a refinement of the techniques.

In another experiment, Deci (1971; Experiment 3) used the same experimental paradigm to investigate the effects of verbal reward. The reinforcement contingency introduced in the second session was verbal praise, rather than money. During the second phase, subjects in the experimental group were told after each trial that their performance was very good or much better than average. Deci found that the reinforced group spent significantly more time on the task (difference scores between session 3 and session 1) than those who received no praise ($p < .05$). These results suggest that social reinforcers may increase the motivation to perform an activity.

One of the best known and most cited studies on the detrimental effects of reinforcement on behavior is the work of Lepper, Greene and Nisbett (1973). In this study, nursery school children were observed in a free play period to determine their initial interest on an activity (drawing). Two observers sat behind a one-way glass and recorded the amount of time each child was engaged in the activity. Those children who spent the most time on the task were selected as subjects for the experiment. Three experimental conditions were employed. In the 'expected' reward condition, children were offered a 'good player award' which they received for drawing with magic markers. Children in the 'unexpected' reward group received the award but were not promised it beforehand, and 'no reward' subjects did not expect nor receive an award.

In a subsequent free play session, those children who were promised an award (expected reward subjects) spent significantly less time drawing than the other two groups. Furthermore, the expected reward group spent less time drawing in the post experimental session than they had in the initial session (pre-experimental free play session). The unexpected reward and no reward subjects showed slight increases in time on task from pre-experimental to post-experimental sessions. Lepper et al (1973) suggested that their results provided "empirical evidence of an undesirable consequence of the unnecessary use of extrinsic rewards" (p. 136).

It is interesting to note that those who had received an unexpected reward spent more time on the task during the post-experimental free-play period than either the expected reward or the control group. Since the unexpected and expected reward groups are both reinforcement conditions, it seems hasty to conclude that these results demonstrate the negative effects of reinforcement. Perhaps reinforcement is not the critical variable. Rather, the promises made or the instructions given could have produced these results. This conclusion is strengthened by recognizing that reward was held constant in the unexpected and expected groups; what differed was promise or

no promise. In spite of this difficulty, the findings of Lepper et al's (1973) study are frequently cited in journal articles and introductory psychology textbooks as evidence that extrinsic reinforcement/rewards undermine intrinsic interest.

The early studies by Deci (1971) and Lepper et al (1973) have raised a number of issues and controversies that have generated considerable research. Some psychologists have claimed that the original findings provide evidence for the view that *reinforcement* decreases intrinsic motivation (e.g., Schwartz, 1990). Others recognize that not all types of reinforcement undermine intrinsic interest (i.e., verbal praise vs tangible reward, expected vs unexpected reward). Still others argue that one must demonstrate that rewards are, in fact, reinforcers before any statements about the effects of reinforcement can be made. Several researchers are cautious about equating 'reward' with 'reinforcement'; their focus has been to discover when and under what conditions *reward* is detrimental.

Thus, the original question "Does reinforcement produce decrements in intrinsic motivation?" has been approached and/or altered in a variety of ways. Some studies are aimed at assessing the effects of 'reinforcement' on intrinsic motivation. Others focus on the effects of 'rewards'; while in a large number of studies, reinforcement is seen as synonymous with reward.

In order to address these issues, researchers have employed a variety of research paradigms. What follows is a description of the various research designs used, the variables that have been investigated, and the major findings.

Group Designs

The majority of studies designed to investigate the effects of reinforcement/reward on intrinsic motivation have been conducted using group designs. Typically, one of two methods is employed. The first method, referred to as a 'before-after' design (Deci & Ryan, 1985), involves a three session paradigm similar to the one

used by Deci (1971). In these studies, a baseline measure of intrinsic motivation on a particular task is taken. This entails measuring time on task in the absence of extrinsic reward, usually from a session of short duration, e.g., ten minutes. Subjects are then assigned to a reward or no reward (control) condition and an intervention with extrinsic rewards is carried out. Following this, reward is withdrawn and time on task is again measured. The procedure is identical for both groups except that control subjects do not experience the intervention in the second session. Mean differences between pre- and post-intervention are calculated for each group and the scores for the experimental and control subjects are then statistically compared. Any difference between the two groups is considered evidence of the effects of the reward intervention.

One advantage to the before-after procedure is that it allows the researcher to examine differences within groups from pre- to post-experimental sessions as well as differences between groups. In most studies of this type, however, only differences between groups are investigated. This is because the before-after procedure has generally been used to identify individuals who show an initial interest in a specific task; those people are then selected as subjects for the study. In such cases, differences between rewarded and non-rewarded subjects are usually measured in the after-reward session only. A major criticism concerning the before-after design (see Mawhinney, 1990) is that intrinsic motivation is rarely measured during the intervention phase. Thus, conclusions regarding the effects of rewards are necessarily inferred from differences between the rewarded and non-rewarded groups.

Most researchers have used an 'after-only' between group experimental design to assess the effects of rewards on intrinsic motivation. In this approach, no pre-treatment measure of intrinsic interest is collected. In the typical experiment, subjects are presented with a task that is assumed to be intrinsically motivating -- solving and assembling puzzles, drawing with felt tipped pens, word games, and so on. Experimental subjects are rewarded with money, or grades, candy, praise, good player

awards, etc. for performing the activity. In some studies, the reward is delivered contingent on a certain level of performance on the task; in others, subjects are simply rewarded for participating in the task. Control subjects are not rewarded. Experimental treatment is usually conducted over a ten minute to one-hour period. All groups are then observed during a non-reward period. This usually occurs immediately after the experimental session although some researchers have observed subjects several weeks later. If experimental subjects spend less time on the task (during the post-reward observation) than the controls, reinforcement/reward is said to undermine intrinsic motivation.

Findings from the Group Design Studies

Generally, the results of the group design studies examining the effects of rewards are conflicting. While some researchers have found that rewards lead to decreased time on the task relative to control groups (e.g., Deci, 1971; Fabes, 1987; Morgan, 1981;), others report the opposite (e.g., Brennan & Glover, 1980; Deci, 1972a; Harackiewicz, Manderlink & Sansone, 1984). Many studies report no significant differences. Results from studies investigating the long term effects of rewards (i.e., time on task four to five weeks after the experimental session) are also contradictory. Some researchers report lasting negative effects (e.g., Ross, 1975, Experiment 1); others report that all subjects, regardless of experimental treatment, return to their initial interest levels (e.g., Loveland & Olley, 1979).

Not all studies use the free time period as the measure of intrinsic motivation. Other measures have included self reports of task enjoyment, interest, satisfaction, perceived locus of control, perceived competence on task, and willingness to volunteer for future projects without reward. Overall, the results from studies employing these measures do not help to clarify the issue of whether reinforcement/reward leads to decreased intrinsic motivation. Some authors have claimed that individuals who

received a reward reported less task satisfaction, interest, and enjoyment than those who did not receive a reward (e.g., Kruglanski, Alon & Lewis, 1972). Other researchers have found the opposite (e.g., Wimperis & Farr, 1979); several report no significant differences (e.g., Boggiano & Hertel, 1983).

A number of reviewers (e.g., Bates, 1979; Dickinson, 1989; Deci & Ryan, 1985; Morgan, 1984) have noted the contradictory nature of the findings and have attempted to identify the conditions under which extrinsic reward produces decrements in intrinsic motivation. Some of the conditions thought to be critical in determining the impact of reward include the type of reward (tangible or verbal), reward expectancy (expected or unexpected), reward contingency (whether reward is delivered simply for performing the task or is contingent on some specified level of performance), and type of research design used to investigate the issue. Although this categorization system appears useful, few consistent findings emerge.

When verbally praised subjects are compared to a control group, some researchers have found an increase in intrinsic motivation (e.g. Deci, 1971) while others report no significant differences (e.g., Orlick & Mosher, 1978). The same holds true when subjects receiving a tangible reward are compared to controls. While some results provide evidence for a decrease in intrinsic motivation following the receipt of a tangible reward (e.g., Danner & Lonkey, 1981) others indicate an increase (e.g., Rosenfield, Folger & Adelman, 1980).

Comparisons between subjects who receive an unexpected tangible reward and subjects who receive no reward are also not clear cut. Some results indicate that unexpected reward subjects show a decrease in intrinsic motivation (e.g., Orlick & Mosher, 1978), others have found no significant differences (e.g., Greene & Lepper, 1974). Experiments designed to investigate the effects of tangible expected rewards appear to be somewhat more consistent. The majority of studies comparing subjects offered an extrinsic reward to non-rewarded controls do show an undermining effect of

reward. Even so, a few studies demonstrate that expected reward subjects show an increase in intrinsic motivation relative to controls (e.g., Brennan & Glover, 1980).

Morgan (1984) and Deci and Ryan (1985) point out that reward contingency plays a critical role in determining the negative effects on intrinsic motivation. Rewards that are delivered regardless of task performance or participation in the task have been labeled "non-contingent" rewards and are said to have little effect on intrinsic motivation. On the other hand, rewards received for performing or completing an activity (task-contingent rewards) are seen as highly detrimental to intrinsic motivation (Deci & Ryan, 1985). In some studies, subjects receive a reward for attaining a certain level of performance -- performance-contingent rewards. Results from such studies vary. Morgan (1984) suggests that in order to understand the diverse findings with regard to performance-contingent rewards, they need to be further subdivided into rewards that are dispensed in accord with some criterion of excellence, set by reference to norms, or delivered for rate of performance. Deci and Ryan (1985) contend that how subjects perceive the value of performance-contingent rewards determines their effect on subsequent motivation.

Although the distinction between non-contingent, task-contingent and performance- contingent reward appears to be helpful in making sense out of the findings, there are conceptual difficulties. In addition, the terms have been used inconsistently. For example, Rosenfield, Folger and Adelman (1980) compared three groups of subjects. One group was offered a reward for doing a task, another group was offered a reward for completing the task, and the third group was not rewarded. According to Deci and Ryan's (1985) taxonomy, both rewarded groups would be considered task-contingent. However, in discussing the findings from this study, Deci and Ryan (1985) mislabel the group rewarded for task completion as 'performance-contingent' and suggest that the results indicate no difference between the performance contingency and the control group (p. 78).

Although researchers, theorists, and reviewers have attempted to delineate the circumstances in which reward is detrimental to intrinsic motivation, conceptual problems and conflicting results make the findings difficult to interpret. Given the diverse findings reported in this literature, it is not clear what effect, if any, reinforcement/reward has on intrinsic motivation. Presently, it seems premature to make definitive statements about the negative effects of reinforcement. Nonetheless, over the years, several psychologists and educators have attributed decrements in intrinsic motivation to reinforcement contingencies and have cautioned teachers against the use of external incentive programs in classrooms (e.g. Levine & Fasnacht, 1974; Schwartz, 1990). In response to these warnings and conclusions, some behaviorally-oriented researchers have also investigated the effects of reinforcement on intrinsic motivation and have reported more positive outcomes.

Single-subject Designs

One of the problems with the group design research, according to behaviorists, is that researchers employing such a design often refer to their reward manipulation as a reinforcement procedure. In behavioral psychology, a reinforcer is any stimulus which when it follows behavior increases the frequency of that behavior. In most intrinsic motivation studies the researchers do not report whether the promised rewards are, in fact, reinforcers. That is, they have not demonstrated that the events used as rewards increased the frequency of the behavior studied. In addition, critics (e.g., Feingold & Mahoney, 1975, Mawhinney, 1990) suggest that the measurement phases in the group design research are too brief to detect any temporal trends and transition states. In order to address these issues, a few studies have been conducted using single subject designs.

Some researchers have examined the effects of reinforcement on intrinsic motivation with a repeated measures, within-subjects research design. In this

paradigm, subjects are provided with two or three activities during a baseline phase. The activity that is performed the most is then reinforced for several sessions. In the final phase, reinforcement is withdrawn and performance over a number of sessions is compared to performance in the pre-reinforcement baseline phase. Any differences are then attributed to the external reinforcement. This type of design allows the researcher to determine whether the rewards that are administered are truly reinforcers.

The best known study using this design was conducted by Feingold and Mahoney (1975). Five second grade children, studied individually, were given access to two activities (dot-to-dot connections or etch-a-sketch). An experimenter observed the children's performance for eight 15-minute sessions. Following baseline sessions, reinforcement procedures were implemented for the dot-to-dot connections. Children accumulated points exchangeable for toys and candy over four sessions. The reward contingency was then withdrawn and the subjects' rate of performing the activity was observed for eight sessions. After a two-week interval of no experimental contact, the subjects were again observed for ten sessions.

Results indicated a rapid increase in rate of performance during the reinforcement phase. Thus, a reinforcement effect was demonstrated. Removal of the reward did not result in a decrement in the rate of performance either immediately or following a two-week delay. In fact, following removal of reward, subjects displayed an increase in performance relative to their baseline performance, although this difference was not statistically significant.

Other researchers employing a within-subjects, multiple-trial design have reported similar findings (e.g., Davidson & Bucher, 1978; Vasta & Stirpe, 1978). No substantial differences have been found when rate of performance and time on task in post-reinforcement sessions are compared to pre-reinforcement phases. On the contrary, many of the subjects in these studies performed the target activity more in the post-reward phase than they did in the pre-reward phase.

The single subject design studies have received little attention in discussions on the negative effects of reinforcement/reward. In general, critics (e.g., Deci & Ryan, 1985) of these findings suggest that the results are not generalizable since so few subjects are studied in any one experiment. An additional criticism has to do with the lack of a control group. The argument is that in the single subject designs there is no group that performs the activity without reinforcement; thus, one cannot know if there is an undermining effect relative to a control group.

At this point, the results of laboratory investigations into the effects of reinforcement/reward on intrinsic motivation appear contradictory and confusing. A few psychologists, however, have offered theoretical explanations in an attempt to account for this morass of conflicting findings. These accounts are outlined below.

Theoretical Explanations of the Findings

The Overjustification Effect

One explanation that has been put forth to account for the detrimental effects of reinforcement/reward is termed the 'overjustification effect'. The overjustification hypothesis was proposed by Lepper, Greene and Nisbett (1973) and is largely based on attribution (Kelly, 1967) and self perception (Bem, 1972) theories. A person's perceptions about the causes of behavior are seen to influence future motivation and performance. In the presence of external controls, people will attribute their behavior to an external agent; when this is removed future motivation and performance will decrease. Conversely, behavior will be attributed to internal causes in the absence of obvious external controls. Motivation and performance will not be affected.

A decrease in intrinsic motivation following the receipt of a reward has been termed the 'overjustification effect' because it is thought that an external reward provides overjustification for participating in an already attractive activity. Put another

way, when individuals are rewarded for engaging in an already interesting activity, their perceptions shift from accounting for their behavior as self-initiated to accounting for it in terms of the external rewards. That is, they are faced with too many reasons (justifications) for performing the activity and the role of intrinsic motivation is discounted. The result: a decline in intrinsic motivation.

Lepper et al (1973) contended that:

> "If the external justification provided to induce a person to engage in an activity is unnecessarily high and psychologically "oversufficient", the person might come to infer that his actions were basically motivated by the external contingencies of the situation, rather than by any intrinsic interest in the activity itself" (p. 130).

Lepper (1981) has suggested that extrinsic rewards lead to a decrease in intrinsic motivation when they allow perceptual shifts of causality. According to Lepper, this occurs when there is sufficient initial interest in an activity, when the extrinsic rewards are salient, and when rewards do not increase perceived competence.

Deci and Ryan (1985) suggest that the overjustification hypothesis should not be considered a theory of motivation. They argue that self-attributions may affect intrinsic motivation but they do not see them as necessary mediators. Instead, Deci and Ryan (1985) offer 'cognitive evaluation theory' as an explanation for intrinsic motivation. They contend that cognitive evaluation theory can account for the effects of self-attributions without placing them at the centre of changes in intrinsic motivation.

Cognitive Evaluation Theory

Cognitive evaluation theory is based on the assumption that people have innate needs for competence and self-determination. From this perspective, a person's intrinsic motivation is affected by changes in feelings of competence and self-determination. According to Deci and Ryan (1985), events facilitate or hinder feelings of competence and self-determination depending on their perceived informational, controlling or amotivational significance. Events seen as informational indicate to a

person skill in performing a task; hence, competence is facilitated which leads to increased intrinsic motivation. A controlling event is one perceived as an attempt to determine a person's behavior. This diminishes self-determination and intrinsic motivation. An amotivational event provides negative feedback indicating a lack of skill which reduces one's competence and intrinsic motivation.

Cognitive evaluation theory focuses on a person's experiences of an activity. For this reason, Deci and Ryan (1985) emphasize the importance of self-report measures of task interest, satisfaction, and enjoyment as more indicative of intrinsic motivation than the free time on task measure.

In a 1987 article, Deci and Ryan allege that rewards have been found to undermine intrinsic motivation. They state that

> "rewards tend to be experienced as controlling, which of course makes sense, as rewards are typically used to induce or pressure people to do things they would not freely do" (p. 1026).

Although this statement suggests that all rewards produce negative effects, in their book on this topic (written earlier), Deci and Ryan (1985) point out that rewards are not always harmful. The circumstances in which reward is detrimental are outlined. According to cognitive evaluation theory, verbal rewards are informational and do not decrease intrinsic motivation. Tangible rewards, on the other hand, are controlling when their delivery is stated before the reward period (expected rewards). This is because the cognitive evaluation process is believed to begin while the rewarded activity is occurring. Further, rewards promised to persons simply for engaging in a task (referred to as 'expected task contingent' rewards) are controlling and decrease intrinsic motivation. Deci and Ryan (1985) suggest that rewards delivered to a person contingent on a specified level of performance are more complicated. This type of reward can be informational or controlling depending on how well a person performs in relation to the specified performance standard.

Although cognitive evaluation theory appears to account for the diverse findings of the effects of reward on intrinsic motivation, there are many difficulties with this interpretation. One major problem is that feelings of competence and self-determination are seen as causes of changes in intrinsic motivation but they are not measured. They are assumed to be operating because behavior changes. In other words, the existence of competence, self-determination, and intrinsic motivation is inferred from the very behavior it supposedly causes. Another serious weakness with the theory is that rewards are defined as controlling or informational after their effect on performance has been measured. In this sense, it is not possible to disconfirm cognitive evaluation theory since explanations are made post hoc to fit the data. A further criticism has been pointed out by Bandura (1977) who notes that applications of reinforcement can produce later reductions in performance without transforming the nature of motivation. Behavioral contrast, satiation, and tedium are but a few examples of ways in which behavior on a particular task is altered. In addition, Bandura suggests that decreases in performance may reflect reaction to how rewards are presented rather than to the rewards themselves.

Given these difficulties, some behaviorally-oriented psychologists have attempted to account for the findings without reliance on motivational constructs.

Recent Behavioral Accounts of the Findings

As noted previously, behaviorists have stressed the importance of making a distinction between rewards and reinforcers. Dickinson (1989) pointed out that the reward procedures adopted in the group-design studies differ from typical reinforcement procedures. Reinforcement procedures involve the repeated presentation of the consequent stimulus contingent upon the relevant behavior. In the group design research, instructions and promises of reward replace repeated contingent delivery. In

addition, the events used as rewards are rarely shown in these studies to increase the frequency of task behavior.

In a review of Deci and Ryan's (1985) book, Bernstein (1990) suggests that Deci and Ryan do not recognize the way behavior analysts differentiate contingency procedures. An operant analysis of behavior involves consideration of a prior learning history and the 'three-term contingency', the S^D: R -> S^r relationship. The three terms are: a) discriminitive stimulus (S^D) or setting event, b) the response (R) or behavior, and c) contingent reinforcement (S^r). Flora (1990) has suggested that all of the empirical results of the intrinsic motivation research can be accounted for by considering the promised reward procedures (expected reward) as discriminitive stimuli. That is, telling a person that he/she will receive a reward is a stimulus event that *precedes* the operant and, as such, is a discriminative stimulus rather than a reinforcer.

Although discriminitive stimuli are part of the three term contingency and affect the probability of an operant, they can and do have very different effects from reinforcers. Thus, task performance evoked by instructions and promises of reward (S^D's) can be influenced by a number of factors such as the subject's history with respect to whether promised rewards were actually received, the subjects verbal repertoire, the nature of prior exposure to the object being offered as the reward, and so on (Dickinson, 1989).

Summary and Discussion

Over the last twenty years, the literature on intrinsic motivation has generated considerable controversy. Intrinsically motivated behavior is defined as behavior for which there is no reward except the activity itself (Deci, 1975). Several critics (e.g., Bandura, 1977; Dickinson, 1989; Flora, 1990) describe intrinsic motivation as an illusory construct and argue that one would be hard put to find a situation with no

external inducements for behavior. In spite of such criticisms, the term intrinsic motivation is frequently used by educators and psychologists and is said to result in creativity, flexibility, and spontaneity (Deci & Ryan, 1985).

In the early 1970's, several psychologists suggested that external reinforcement might interfere with intrinsic motivation. The concern was (and is) that the implementation of reinforcement contingencies in educational settings, hospitals, the workplace, and other institutions might, in fact, be causing more harm than good. This concern led to a great deal of research on the topic.

Various research designs have been employed to investigate the effects of reinforcement/reward on peoples intrinsic motivation. In general, the findings are conflicting and it is difficult to make any definitive statements about a negative effect. One issue that should be clear from a reading of this review, however, is that in the vast majority of studies the reward procedure did not constitute a reinforcement contingency. The few experiments that did demonstrate a reinforcing effect did not find reinforcement to be detrimental to intrinsic motivation. The point is that statements about the negative effects of reinforcement (e.g, Schwartz, 1990) are not warranted given the results of studies on this issue.

As far as the effect of *reward* on intrinsic motivation goes, it is difficult to say whether there is a negative effect. For each study that shows a negative effect, one can find another with opposite results. Nonetheless, several researchers have interpreted the findings as negative and decry the use of rewards in educational and work settings.

In the 1970's the message was that "the results of these studies indicate the trepidations the practitioner should have before instituting a token program" (Levine & Fasnacht, 1974; p.817). In the 1980's and 90's the message has spread from prestigious psychological journals such as *American Psychologist* to many realms of education and business. On the basis of Deci and Ryan's work, Kohn (1988) argued (in the business magazine *Inc.*) that "Incentives can be bad for business". In a major

English as a second language journal, H.D. Brown (1991) outlined the major issues in that field and stated that "An overwhelming body of research now shows the superiority of intrinsic motivation in controlled settings" (p. 247). He went on to say that

> "...if learners in our classrooms are given an opportunity to 'do' language for their own personal reasons of achieving competence and autonomy, surely those learners will have a better chance of success than if they become dependent on external rewards for their motivation" (p. 248).

Such messages have had a great impact on society at large. For example, a local high school in Edmonton has recently implemented an incentive system to get students to attend school. The principal is happy and the attendance has gone up. But in a recent phone-in show on CBC radio, many callers were troubled by this arrangement and suggested that this was 'bribing' the children which would prevent them from ever being motivated to learn 'for the sake of learning'. One can see from this example that the concerns expressed in the academic literature have been filtered to the broader society.

In general, the view is that rewards/reinforcement decrease intrinsic motivation. However, the present review of the literature suggests that this view may not be correct. Although various reviewers have attempted to describe the relation between reinforcement/reward and intrinsic interest and continue to say that the major issues are resolved, they inevitably come from their own theoretical positions. Thus, their reviews are highly critical of research designed outside of their own paradigm and, more often than not, findings from studies in opposing camps are not even discussed. For these reasons, the literature and its interpretations are still contentious. A possible resolve is suggested by recent attempts at meta-analysis on controversial topics like this one. The following chapter presents a meta-analysis of the literature on the effects of reinforcement/reward on intrinsic motivation.

The meta-analysis which follows is not the first attempt to use quantitative methods to analyze the literature on intrinsic motivation. Rummel and Feinberg (1988) conducted a meta-analysis to assess cognitive evaluation theory. Subjects who received rewards that were defined to convey 'controlling' information were compared to groups receiving other types of rewards or no reward. The dependent measure of intrinsic motivation was a combination of both free time on task measures and self reports of satisfaction and task interest. Results provided support for cognitive evaluation theory. Rummel and Feinberg concluded that controlling extrinsic rewards have detrimental effects on intrinsic motivation.

A major problem with Rummel and Feinberg's analysis was that rewards were defined as controlling after the fact. That is, when a certain type of reward was found to produce a negative effect, it was seen as controlling and the study was selected for the meta-analysis. Given this bias, many studies that did not produce a negative effect were excluded. Although this analysis may be adequate with reference to cognitive evaluation theory, it does not address the overall issues as defined in this literature. This is not surprising since their analysis was designed to evaluate cognitive evaluation theory rather than the more general question: What are the effects of reinforcement/reward on intrinsic motivation? It is this question that has been the focus of much controversy.

III. A Quantitative Review of The Literature

A prevailing view in social psychology is that rewards decrease a person's motivation to perform an intrinsically interesting task. Rewards are often equated with reinforcement; hence, reinforcement is said to produce decrements in intrinsic motivation. This view has had an impact on education and recently, its importance has been recognized in business journals. Although a handful of studies and authors have taken issue with this contention, the general conclusion has been widely accepted by psychologists and educators. A detailed examination of the literature, however, suggests that the issue is not clear cut. Results from experimental investigations on the effects of reward/reinforcement on intrinsic motivation are often conflicting. Since a substantial number of studies have been carried out to assess this issue, one way to evaluate their effects is to conduct a meta-analysis. This chapter presents a meta-analysis of studies on intrinsic motivation, assessing the magnitude of differences between rewarded and non-rewarded subjects, as well as factors that may be related to differences.

Meta-analysis is a method of quantitative aggregation involving the statistical analysis of the summary findings of many studies. It is a way to organize the results of studies so that they can be more easily viewed and understood. Since results from both strong and weak studies are combined, meta-analysis is deemed to help reviewers avoid selection bias and keep focused on the broader issues.

The primary purpose of the present meta-analysis is to make a causal statement about the effects of extrinsic rewards/reinforcement on intrinsic motivation. This analysis should be useful in addressing a number of concerns. Of major importance is whether the bulk of evidence suggests that extrinsic rewards/reinforcement produce decrements in intrinsic motivation. If so, what is the size of any relationships being uncovered? If not, should the matter be dropped and our attention turned elsewhere?

Also, do different patterns emerge with different reward types (e.g., tangible, verbal rewards), different reward expectancies (expected, unexpected), or different reward contingencies (e.g., contingent, non-contingent)? In this chapter, the research questions addressed in the present meta-analysis are outlined, the steps involved in conducting the meta-analysis are described, and findings are presented and discussed.

Research Questions

The following questions have been addressed in this meta-analysis:

1) *Overall, what is the effect of reward/reinforcement on intrinsic motivation?* In order to answer this question, two separate analyses were conducted. One analysis included only group designs. Subjects who received a tangible reward and/or an extrinsic verbal reward were compared to a non-rewarded control group. This analysis should shed light on the overall effects of 'reward' on intrinsic motivation.

One of the criticisms of the group designs has been that reward is frequently cited as synonymous with reinforcement, yet no evidence has been provided to indicate that the rewards used in group designs are actual reinforcers. In the single-subject, repeated measures designs, researchers have demonstrated that the rewards administered increased behavior and can be considered as reinforcers. For this reason, a separate analysis was conducted with the single-subject designs where subjects served as their own controls. This analysis should allow a more definitive statement to be made about the effects of 'reinforcement' on intrinsic motivation.

2) What are the effects of specific features of reward on intrinsic motivation? Several researchers note that intrinsic motivation is affected differently by the type of reward

implemented, the reward expectancy and the reward contingency. Specifically, researchers have investigated the following:

a) the effect of verbal reward on intrinsic motivation,

b) the effect of tangible reward on intrinsic motivation,

c) the effect of expected reward on intrinsic motivation (i.e., rewards promised and delivered to subjects),

d) the effect of unexpected reward on intrinsic motivation (i.e., rewards delivered but not promised),

e) the effect of non-contingent reward on intrinsic motivation (i.e., rewards delivered simply for participating in a task),

f) the effect of contingent reward on intrinsic motivation (i.e., rewards delivered for completing or solving a task and/or achieving a specified level of performance).

All analyses performed on these features were conducted with group design studies in which a rewarded group was compared to a control group. These analyses should lead to a greater understanding of the specific conditions under which reward affects intrinsic motivation.

Method

Selection of Studies

A basic list of studies was assembled by conducting a computer search of the psychological literature (PSYCH LIT) using 'intrinsic motivation' as the search term. Relevant articles published up to September 1991 were identified. Studies not listed on the computer data base were identified through the bibliographies of review articles, chapters, books, and papers located in the original search.

Two sets of studies were collected. The main analysis entailed assessing the overall effects of reward/reinforcement on intrinsic motivation from studies involving group designs. Criteria for including studies in the sample were that a) the study involved an experimental manipulation of a reward/reinforcement condition and included a non-rewarded control group; b) any characteristics of rewarded subjects were either held constant or varied but represented identically for both rewarded and control groups; and c) studies were published (no unpublished documents were collected) and written in English. In addition, only studies that measured intrinsic motivation as a dependent variable were included.

Intrinsic motivation has been measured as free time on task after withdrawal of reinforcement/reward; self reports of task interest, satisfaction, and/or enjoyment; and subjects' willingness to participate in future projects without reward. One study which met the criteria was excluded (Boggiano & Ruble, 1979) because the statistical contrasts used in the article were not logical given the sample size of the study[1] . Other studies were omitted from the sample if some subjects in a reward condition were not actually given a reward (e.g., Pritchard, Campbell & Campbell, 1977). The resulting sample consisted of 83 documents reporting 95 independent studies.

A major criticism of the meta-analytic technique has been that researchers often lump different measures together. This has been referred to as the "apples and oranges problem" in that it is argued that logical conclusions cannot be drawn from comparisons of studies using different measures of the dependent variable (see Glass, McGaw & Smith, 1981). In order to avoid this problem, separate analyses were conducted on the overall effect of reward for each measure of intrinsic motivation. By this strategy, 11 studies compared a rewarded group to a control group on the 'willingness to volunteer

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[1] Boggiano & Ruble (1979) reported that 147 children participated in the study. There were 2 reward conditions (non-contingent & contingent) and a non-rewarded control group. The contrast for the control vs non-contingent reward groups on the free time measure is reported as $t(130) = 2.0$, $p<0.05$; the contrast for the control vs contingent reward groups is reported as $t(130) = 1.16$, ns.

for future studies without reward' measure, 61 studies assessed the 'free time on task' measure, and 64 studies investigated the 'attitude' (task interest, enjoyment and satisfaction) measure of intrinsic motivation.

In order to assess the impact of specific features of reward, further analyses were conducted with data from the 95 group design studies. In these analyses, subjects assigned to different types of rewards (tangible, verbal), reward expectancies (unexpected, expected) and reward contingencies (contingent, non-contingent) were compared to non-rewarded control groups.

The second meta-analysis was conducted on studies that employed a single-subject, multiple-trials design. In this type of design, subjects served as their own controls. These experiments are conducted in three phases with a number of sessions in each phase. Baseline measures of intrinsic motivation are taken in the first phase, reinforcement procedures are then implemented over a number of sessions, and in the third phase reinforcement is withdrawn. Changes in intrinsic motivation are measured as differences between the pre- and post-reinforcement phase. Studies were included in this analysis when: a) a reinforcement effect was demonstrated (i.e., the rewards used showed an increase in behavior), and b) baseline and post-reinforcement phases involved repeated measures. One study reporting a reinforcement effect was excluded (Vasta, Andrews, McLaughlin, Stirpe & Comfort, 1978, Experiment 1) because the authors reported only one measure of behavior during the post-reinforcement phase. In all, five studies were located for this analysis.

A list of studies included in the meta-analyses is presented at the end of this chapter.

Coding of Studies

Once all relevant articles had been collected, each study was read and coded. The following general information was extracted from each report: a) author(s), b) date

of publication, c) publication source, d) population sampled (children or adults), e) sample size, f) type of experimental design (before/after groups design, after-only groups design, or single subject multiple trial design, and g) type of task used in the study.

The following aspects of the independent variable were also coded: a) reward type (tangible or verbal), b) reward expectancy (expected or unexpected) and c) reward contingency (non-contingent or contingent). Non-contingent rewards were defined as rewards delivered for participation in a task regardless of level of performance. Contingent rewards referred to rewards delivered for completing or solving a task and/or achieving a specified level of performance. This distinction is slightly different from that proposed by Deci and Ryan (1985). As was pointed out in the preceding literature review, Deci and Ryan's taxonomy of reward contingencies has been used inconsistently. For this reason, their categorization scheme was not used in the present analyses.

Other characteristics of studies that were coded were: a) type of dependent measure (e.g., free time on task, task interest, etc.), b) whether experimenter was blind to conditions, and c) whether experimenter was present or absent during the post-reward phase. As well, statistical information was recorded and effect sizes were calculated from appropriate contrasts. Table 3.6 at the end of this chapter summarizes descriptive characteristics and effect sizes of the reviewed studies.

Computation and Analysis of Effect Sizes

The procedures used in the meta-analysis of the group design studies followed those of Hedges and Olkin (1985). Meta-analysis is a statistical technique for aggregating the results of many experimental studies which compare two groups on a common dependent measure. Once the studies and groups to be compared are identified, the statistical result of each study is transformed into a measure called an

effect size. An effect size is found by converting the findings from each study into a standard deviation unit. The effect size indicates the extent to which experimental and control groups differ in the means of a dependent variable at the end of a treatment phase. In its simplest form, the effect size calculated, 'g', is the difference between the means of the rewarded group and a non-rewarded control group divided by the pooled standard deviation of this difference. When means or standard deviations were not available from reports, effect size was calculated from t tests, F statistics, and p-level values (e.g., $p < .05$). Formulas for calculating effect size are listed in Appendix A.

One problem that arises in conducting a meta-analysis is determining effect sizes from studies with limited information. In a few studies, for example, contrasts are simply reported as t or $F < 1.00$. In such cases, effect size estimates were calculated by making t or F equal to a number between 0.01 and 1.00 chosen from a random numbers table. When results from a study were reported as non-significant and t or F values were not available but means and/or direction of means were known, a random number between 0.01 and the critical value of t or F at $p = .05$ was chosen to calculate an estimate of effect size. When results for an outcome measure were not reported or were reported as non-significant and means and direction were unknown, the effect size for that measure was set at 0.00 (indicating exactly no difference between rewarded and non-rewarded groups). For each analysis, results were calculated with 0.00 values included and with 0.00 values omitted.

For several studies more than one effect size was calculated. For example, if a single study contained two measures of intrinsic motivation (e.g., free time on task, attitude) and two types of reward groups plus a control group (e.g., tangible reward, verbal reward), a total of four effect sizes was calculated (e.g., free time - tangible reward, free time - verbal reward, attitude - tangible reward, attitude - verbal reward).

In order to satisfy the independence assumption of meta-analytic statistics (Hedges & Olkin, 1985), only one effect size per study was entered into each analysis.

When two or more effect sizes from one study were appropriate for a particular analysis, these effect sizes were averaged. To illustrate, for the estimate of the overall effect of reward on the free time measure of intrinsic motivation, some studies assessed the effects of several types of rewards. If a single study, for example, contained two or more reward groups (e.g., non-contingent reward, contingent reward) and a control condition, the two effect sizes were averaged so that the study contributed only one effect size to the overall analysis of reward. For an analysis of the effects of non-contingent reward on intrinsic motivation, only the one appropriate effect size from the study would be used. This strategy retained as much data as possible without violating the assumption of independence. Average effect sizes were obtained by weighting each g index by the number of participants on which it was based (see Cooper, 1989).

As was previously mentioned, in the single-subject, repeated-measure designs, there is no separate control group; subjects serve as their own controls. Measures such as time on task are taken over a number of sessions in a baseline phase. Reinforcement procedures are then introduced. Following this, reinforcement is withdrawn and time on task is again measured over a number of sessions. An increase or decrease in intrinsic motivation is indexed by a difference in the amount of time spent on the task between baseline and post-reinforcement sessions. Effect sizes for these studies were calculated by subtracting the average time spent by all subjects in the baseline phase from the average time spent by all subjects in the post-reinforcement phase. This number was then divided by the pooled standard deviation.

After all effect sizes were calculated, the analyses were run on the computer program *Meta* (MS-DOS version 5.0 by R. Schwarzer). Results reported in this chapter are based on the weighted integration method (Hedges & Olkin, 1985). By this technique, effect sizes g are converted to d's by correcting them for bias (g is an overestimation of the population effect size, particularly for small samples; see Hedges, 1981). To obtain an overall effect size, each effect size is weighted by the reciprocal of

its variance and the weighted d's are averaged. This procedure gives more weight to effect sizes that are more reliably estimated. Once mean effect sizes are calculated, 95% confidence intervals are constructed around the weighted mean.

In order to verify the accuracy of the computer program, one analysis (the overall effect of reward on free time) was hand calculated. All obtained values from the meta-analysis program and the hand calculations were identical within rounding error.

To determine whether each set of effect sizes in a sample shared a common effect size (i.e., was consistent across studies), a homogeneity statistic, Q, was calculated. Q has an approximate chi-square distribution with k-1 degrees of freedom, where k is the number of effect sizes (Hedges & Olkin, 1985). The null hypothesis is that the effect sizes are homogeneous (that is, effect sizes in a given analysis are viewed as values sampled from a single population; variation in effect sizes among studies being merely due to sampling variation). For purposes of the present analyses, samples were considered homogeneous at $p < .01$.

When samples are not homogeneous, studies can be classified by characteristics, such that effect sizes within categories are homogeneous. This strategy was undertaken by examining the effects of different types of rewards, reward expectancies, and reward contingencies.

As a supplementary analysis, homogeneity was attained by removing outliers. That is, studies were omitted when they provided estimates that were inconsistent with those from other studies. Outlier's in each data set were first identified using Tukey's (1977) procedure. These outliers were then omitted from the analysis. If homogeneity was still not attained, other studies which reduced the homogeneity statistic by the largest amount were removed. Hedges (1987) has pointed out that this is a common procedure in both the physical and social sciences. In one area of physics, for example, Hedges (1987) found that data from 40% of the available studies were omitted from calculations. For meta-analyses of psychological topics, Hedges (1987)

notes that removal of up to 20% of the outliers in a group of heterogeneous effect sizes, usually results in a high degree of homogeneity.

In a recent article in *Psychological Bulletin*, McGraw and Wong (1992) noted that one of the problems with effect size statistics (e.g., 'd') is that many readers of meta-analyses have difficulty interpreting the meaning and generalizability of findings. McGraw and Wong (1992) have introduced another way to look at effect size, by a statistic they call the 'common language effect size' indicator (CL). CL refers to the probability that a score sampled from one distribution will be greater than a score sampled from some other distribution. McGraw and Wong (1992) suggest that CL is a useful way to talk about effect size because it is easily interpretable. They provide an example in which a sample of young adult men is compared to a sample of young adult women on the variable height. A CL of .92 indicates the probability of a male being taller than a female. Put another way, in any random pairing of young adult men and women, the male will be taller than the female 92 out of 100 times.

CL is calculated from means and standard deviations. Additionally, an effect size, d, can be converted to CL by multiplying d by $1/\sqrt{2}$ or 0.707 to obtain a Z value (K.O. McGraw, personal communication, April 24, 1992). The upper tail probability associated with this value corresponds to CL and can be calculated using the unit normal curve.

To test the robustness of the CL statistic, McGraw and Wong (1992) conducted a series of 118 tests (simulations) to determine the implications of violating the assumption that sample data come from populations of values that are normally distributed with equal variances. They found small discrepancies between the estimate of CL under the normality assumption and the estimate of CL when the normality assumption was violated in terms of skewness and kurtosis. The worst case discrepancy was 0.1 which occurred with a large violation of the equal variance assumption, considerable negative skewness, and a large violation of kurtosis. Given

the robustness of CL and the ease in which it can be interpreted, results from the present analyses have also been expressed using the CL statistic.

The meta-analytic procedures used in the present review include: a) the estimation of average effect sizes and 95% confidence intervals, b) homogeneity analyses to determine whether effect sizes are drawn from the same population, c) removal of outliers to attain homogeneity, and d) conversion of average effect sizes to the common language statistic (CL).

Results from Group Designs

The Overall Effect of Reward on Intrinsic Motivation

To assess the overall effect of reward on intrinsic motivation, separate analyses were performed on each of the three different measures of intrinsic motivation (free time on task, attitude, and willingness to volunteer for future studies without reward). For each measure, negative effect sizes represent a decrement in intrinsic motivation; positive effect sizes indicate an increment.

The number of studies collected for each analysis of the overall effects of rewards on intrinsic motivation and their outcomes are given in Table 3.1. On the free time measure, the majority of studies showed that reward decreased intrinsic motivation. However, when intrinsic motivation was measured by attitude toward a task or willingness to volunteer for future studies without reward, more studies showed positive effects.

Table 3.1
Outcomes of studies investigating the effects of reward versus control groups on intrinsic motivation

	Free time	Attitude	Willingness to volunteer
Number of studies showing a positive effect of reward	22	31	6
Number of studies showing a negative effect of reward	34	15	4
Number of studies showing no effect	1	1	-
Number of studies with lack of sufficient information to calculate effects	4	17	1
Total number of studies	61	64	11

Distribution of Effect Sizes

Frequency distributions of the data are shown in Figure 3.1. Studies that found no significant differences but did not provide sufficient information to calculate effect sizes are not portrayed in the graphs.

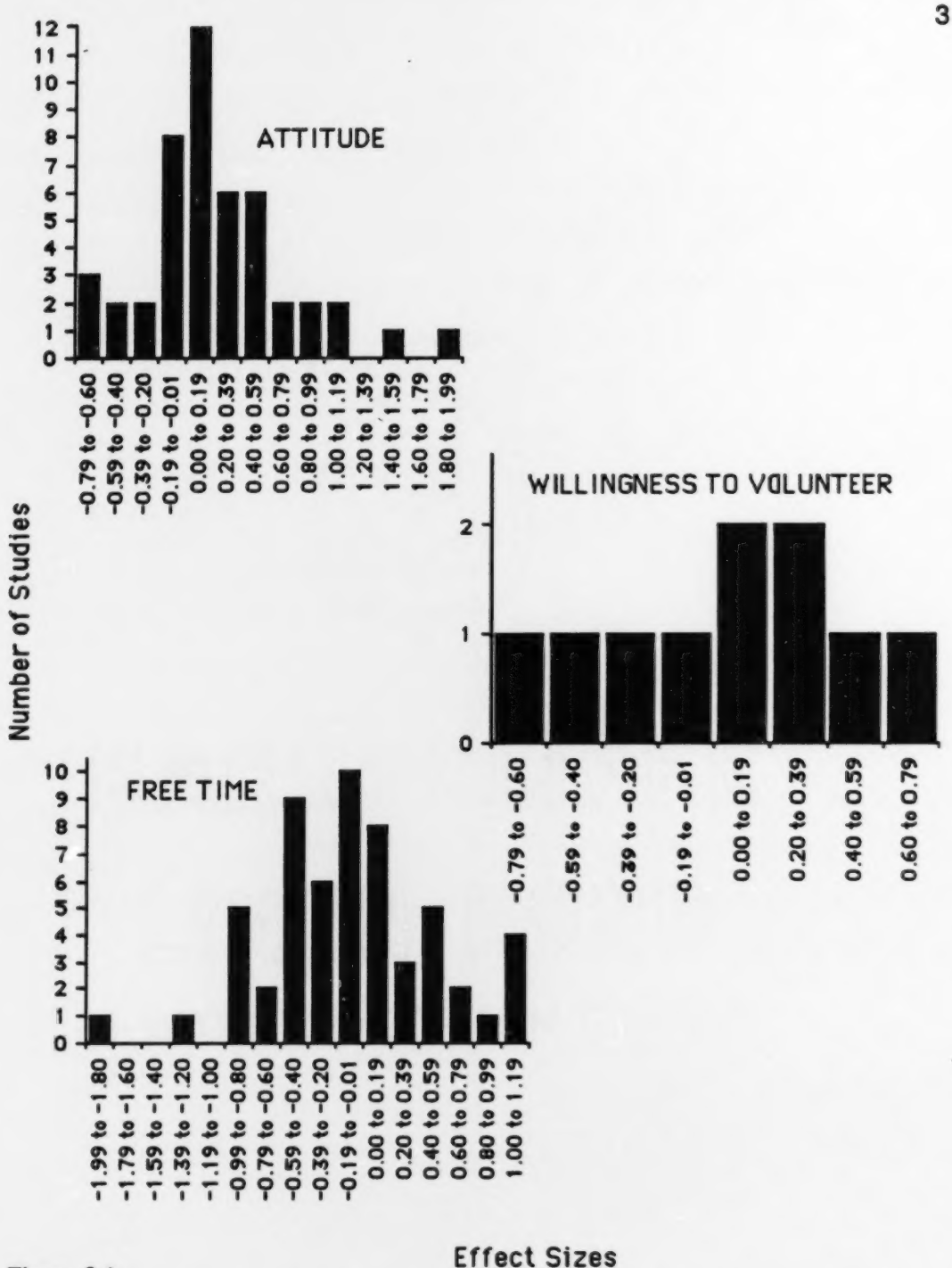

Figure 3.1.
Frequency distributions of effect sizes for overall reward versus control groups on three measures of intrinsic motivation

When intrinsic motivation is measured as time on task following the removal of a reward (free time), effect sizes ranged from -1.94 to 1.06. The bulk of experiments found effects between -0.59 and 0.19.

Using Tukey's (1977) procedure, one negative outlier was identified in the free time data. This effect (g = -1.94) was calculated from a study conducted by Morgan (1983, Experiment 1). In this study, subjects who received an expected, non-contingent, tangible reward were compared to no-reward control subjects. The large negative effect could be due to the type of reward (tangible), the reward expectancy, and/or the reward contingency. All of these features are examined in further analyses. In addition, this study was somewhat different from other studies in that subjects who performed the activity for a reward were observed by other subjects. That is, subjects were offered a reward for engaging in an activity and their performance on the task was being watched. Thus, the large negative effect could be a result of an interaction of reward type, expectancy, contingency, and surveillance.

The attitude measure of intrinsic motivation refers to subjects' self-reports of task interest, enjoyment, and/or satisfaction. Effect sizes ranged from -0.69 to +1.98 with the majority of effects falling between -0.19 and +0.59. Two positive outliers in this data set come from studies conducted by Vallerand (1983) and Butler (1987). In both of these studies, extrinsic verbal reward is compared to a no reward group. The effect of verbal reward on intrinsic motivation is investigated in a subsequent analysis.

On the 'willingness to volunteer' measure, effect sizes ranged from -0.63 to +0.68. There were no outliers in this sample.

To establish whether the CL statistic (McGraw & Wong, 1992) could be used confidently in the analyses, the extent to which the free time distribution of effect sizes deviated from normality was determined. Obtained values for skewness and kurtosis were -0.21 and 0.55, respectively (where normal skewness and kurtosis equal 0.00). McGraw and Wong (1992) tested the effect that violations from normality would have

on CL. Based on their findings and the skewness and kurtosis values obtained here, in the meta-analysis of effect sizes for the free time measure, one could expect at worst an underestimate of 0.02 and an overestimate of 0.04 for CL. Given this small discrepancy, the implication is that the CL statistic can be used and interpreted without any serious concern about violations of normality and homogeneity of variance.

Meta-analysis of effect sizes

The overall meta-analysis of effect sizes presented in Table 3.2 allows one to determine whether rewarded subjects showed less intrinsic motivation than non-rewarded subjects as measured by time on task following the removal of reward (free time); self reports of task interest, satisfaction, and enjoyment (attitude); and willingness to volunteer for future studies without reward. Recall that a negative effect supports the hypothesis that rewards decrease a person's intrinsic motivation; a positive effect indicates an increase.

For each measure of intrinsic motivation, an analysis was conducted which included all studies that provided sufficient information to calculate effect sizes (see "All known effects" in Table 3.2). When samples were not homogeneous, outliers were identified and removed using Tukey's (1977) procedure. If samples were still significantly heterogeneous, additional outliers were removed. Homogeneity was attained for the free time and attitude measures by omitting approximately 20% of the effect sizes, a typical meta-analytic procedure. An examination of Table 3.2 indicates that this procedure did not drastically alter mean effect sizes.

Table 3.2
Overall effect of reward versus control groups on three measures of intrinsic motivation

Free time on task

Analysis	k	Sample size	Mean weighted d	95% C.I for d	Q	CL
All known effects (zeros excluded)	57	3539	- 0.06	- 0.13 to 0.01	225.51 *	.48
Outliers removed using Tukey's procedure (zeros excluded)	56	3459	-0.03	-0.10 to 0.04	177.40 *	.49
Additional outliers removed (no zeros)	44	2634	-0.04	-0.12 to 0.04	66.39	.49
All reports (zeros and outliers included)	61	3858	- 0.06	- 0.12 to 0.01	225.80 *	.48

Attitude

Analysis	k	Sample size	Mean weighted d	95% C.I for d	Q	CL
All known effects (zeros excluded)	47	3184	+ 0.21	0.14 to 0.29	167.50 *	.56
Outliers removed using Tukey's procedure (zeros excluded	45	3034	+0.17	0.09 to 0.24	110.70 *	.55
Additional outliers removed (no zeros)	39	2680	+0.14	0.06 to 0.22	58.03	.54
All reports (zeros and outliers included)	64	4431	+0.15	0.09 to 0.21	177.07 *	.54

Willingness to volunteer

Analysis	k	Sample size	Mean weighted d	95% C.I. for d	Q	CL
All known effects (zeros excluded)	10	561	+ 0.05	- 0.12 to 0.23	17.38	.52
All reports (zeros and outliers included)	11	609	+ 0.05	- 0.12 to 0.22	17.42	.52

Note. Negative effect sizes indicate a decrease in intrinsic motivation for reward/reinforcement groups; positive effect sizes indicate an increase. k = number of effect sizes; Sample size = sum of n in all studies; Mean weighted d = mean of weighted effect sizes (weighted by sample size); C.I. = confidence interval; Q = homogeneity statistic for mean effect sizes, CL = common language effect size statistic.

* Significance indicates rejection of the hypothesis of homogeneity.

* $p < .01$

On the free time measure, rewarded subjects showed slightly less intrinsic motivation than non-rewarded controls (mean weighted d = -0.04) but this effect was not significant (i.e., the confidence interval included 0.00). When the mean effect of the homogeneous sample was converted to CL, results indicate that given a sample of studies designed to investigate the effects of reward on time on task, 49 out of 100 studies would show that rewarded subjects spend more time on the task than non-rewarded controls. Put in terms of the hypothesis (i.e., rewards decrease intrinsic motivation), 51 out of 100 studies would show that rewarded subjects spend 'less' time on a task than those subjects not receiving a reward.

Contrary to the hypothesis that rewards produce less interest and enjoyment of a task, results from the attitude measure indicate greater intrinsic motivation for rewarded subjects. This effect was small at 0.14 (from the homogeneous sample) but differed significantly from the value of 0.00 (i.e., the confidence interval did not include 0.00). The CL statistic was .54 and can be interpreted to mean that in comparisons of rewarded to non-rewarded subjects, rewarded subjects will show a more positive attitude toward a task than non-rewarded subjects in 54 out of 100 studies. Rewarded subjects also showed a tendency to volunteer for future projects more than non-rewarded subjects but this effect was not significant.

Studies that could not be represented with effect sizes were given a value of 0.00. When these studies were included in the overall analyses (see "All reports" in Table 3.2), the mean effect size for each measure was little changed.

Overall, the results show that reward does not significantly affect intrinsic motivation as measured by free time on task following removal of reward or by subjects' willingness to volunteer for future projects without reward. When intrinsic motivation is measured by attitude toward a task, rewarded subjects report higher intrinsic motivation than non-rewarded subjects.

Previous reviewers (e.g., Deci & Ryan, 1985; Morgan, 1984) have suggested that reward type, reward expectancy, and reward contingency may influence the effect of reward on intrinsic motivation. In subsequent analyses, effect sizes have been partitioned into groups based on these characteristics in an attempt to test potential moderator variables and to establish homogeneity of variance.

Effect Size as a Function of Reward Characteristics

In the following section, type of reward and its impact on effect size are presented. Studies are included that measured the effects of either verbal reward or tangible reward (e.g. money) on intrinsic motivation. The second part of this section involves an analysis of reward expectancy (i.e., expected and unexpected rewards). Finally, reward contingency is assessed. Specifically, the question here is whether effect size varies as a function of reward delivered for simply engaging in a task or reward delivered for successful performance.

Studies that could not be represented as effect sizes due to lack of sufficient information are not included in further analyses presented in this chapter. Analyses which include these studies and index effect size as 0.00 are presented in Appendix B.

Type of Reward

The purpose of the present analyses is to assess the effects of different types of rewards (i.e., tangible and verbal) on intrinsic motivation. Because few studies assessed intrinsic motivation as a function of 'willingness to volunteer', no further analyses on this measure have been conducted.

Effect sizes for both types of reward on the free time and attitude measures are presented in funnel distributions in Figure 3.2. Funnel graphs are used to plot effect size against sample size of the study. The advantage of a funnel display is that it capitalizes on a well-known statistical principle (Light & Pillemer, 1984). That is, the

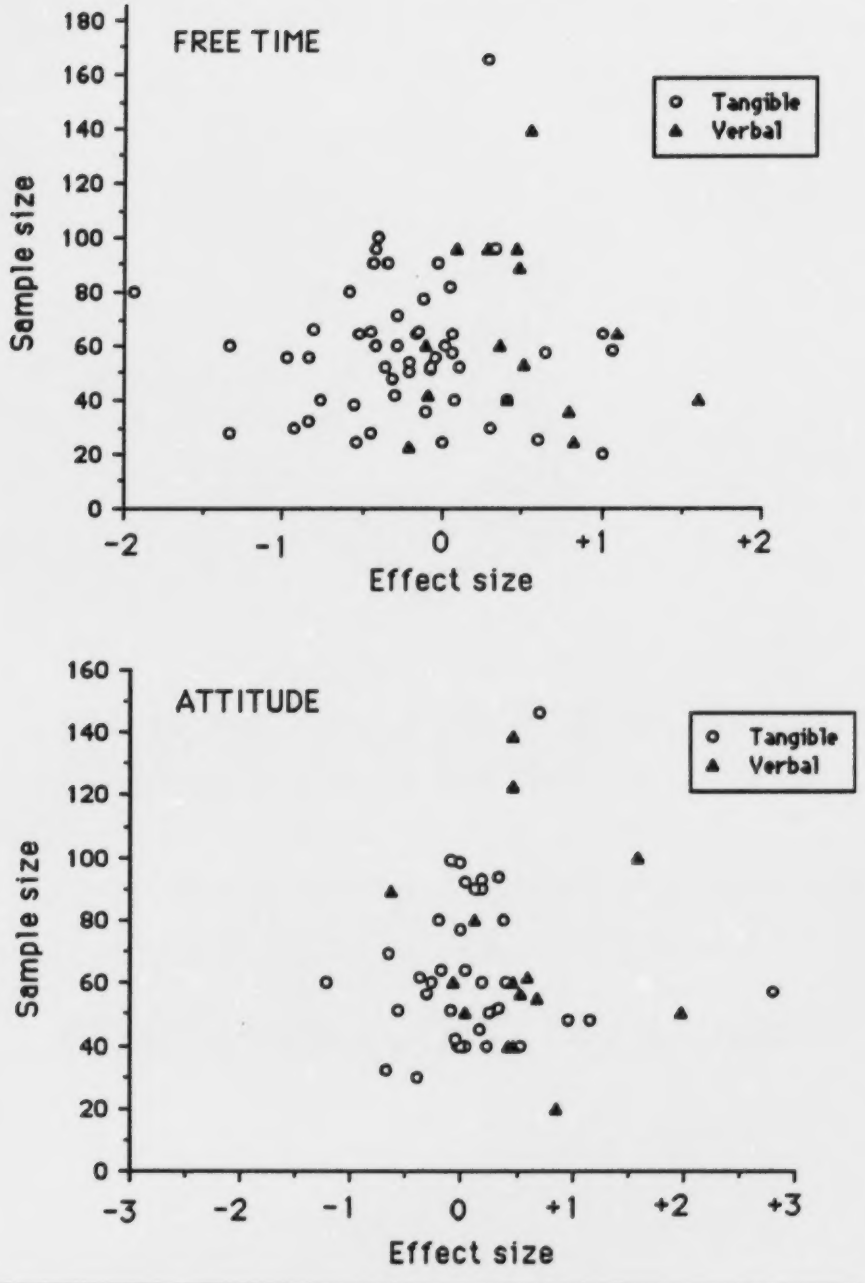

Figure 3.2.
Funnel distributions of effect sizes for tangible and verbal reward on two measures of intrinsic motivation.

larger the sample, the closer the effect size will come to represent the true underlying population value; variability due to sampling error decreases. Conversely, smaller samples are more prone to sampling error and are likely to deviate considerably about the true mean. For these reasons, the distribution is expected to take the shape of an inverted funnel.

An inspection of the funnel distribution of effect sizes for the free time measure indicates that, overall, larger samples tend to concentrate around zero; greater variation is evident with smaller samples. Verbal reward appears to produce a positive effect. Effects of tangible reward suggest a slightly negative effect. On the attitude measure, the overall effect appears to be slightly positive. Positive effects emerge from both tangible and verbal reward studies; verbal reward appears to produce a slightly more positive effect.

Results from the meta-analysis of the effects of reward type are given in Table 3.3.

Table 3.3
Effect size as a function of the type of reward delivered

Free Time on Task

Reward Type	Analysis	k	Sample size	Mean weighted d	95% C.I for d	Q	CL
Verbal	All known effects	15	958	+0.42	0.29 to 0.56	29.37 *	.62
Verbal	Outliers removed using Tukey's procedure	14	918	+0.38	0.25 to 0.52	18.96	.61
Tangible	All known effects	51	2983	-0.20	-0.28 to -0.12	181.01*	.44
Tangible	Outliers removed using Tukey's procedure	47	2761	-0.22	-0.30 to -0.14	97.55 *	.44
Tangible	Additional Outliers removed	43	2591	-0.21	-0.29 to -0.13	63.53	.44

Attitude

Reward Type	Analysis	k	Sample size	Mean weighted d	95% C.I for d	Q	CL
Verbal	All known effects	15	1024	+0.45	0.31 to 0.58	69.71 *	.63
Verbal	Outliers removed using Tukey's procedure	13	874	+0.30	0.15 to 0.43	26.75 *	.58
Verbal	Additional Outliers removed	12	785	+0.39	0.24 to 0.53	8.73	.61
Tangible	All known effects	37	2362	+0.09	0.004 to 0.17	143.29 *	.52
Tangible	Outliers removed using Tukey's procedure	33	2149	+0.05	-0.04 to 0.13	50.56	.52

Note. Negative effect sizes indicate a decrease in intrinsic motivation for reward/reinforcement groups; positive effect sizes indicate an increase. k = number of effect sizes; Sample size = sum of n in all studies; Mean weighted d = mean of weighted effect sizes (weighted by sample size); C.I. = confidence interval; Q = homogeneity statistic for mean effect sizes, CL = common language effect size statistic.
* Significance indicates rejection of the hypothesis of homogeneity.
* $p < .01$

The meta-analysis results of Table 3.3 indicate that when studies compared subjects who received a verbal reward (i.e., praise or positive feedback) to those who did not receive a reward, rewarded subjects demonstrated significantly higher intrinsic motivation as measured by both time on task and attitude. On the time measure, homogeneity was attained by removing one outlier. This extreme positive value (+1.61) was obtained from a study conducted in India (Tripathi & Agarwal, 1985). Since all other studies in this analysis came from North America, the large effect size may have been due to differences in the population studied. Three outliers from studies measuring the effects of verbal reward were removed to achieve homogeneity on the attitude measure. Inspection of these outliers suggested that they did not differ in obvious ways from other studies in the sample except for their tendency to generate extreme values of effect size. From these analyses, one can estimate that the probability of a sample of verbally rewarded subjects being more highly intrinsically motivated than non-rewarded subjects is 0.61 (CL) as measured by time on task and attitude toward task.

Studies assessing the effects of tangible reward on intrinsic motivation show a small decrease on the free time measure as indicated by a negative mean effect size that differed significantly from 0.00. The CL statistic of .44 implies that in a sample of studies, rewarded groups will spend more time on the task in 44 out of 100 cases. In other words, subjects who receive a tangible reward will show a *decrease* in intrinsic motivation as measured by time on task in 56 out of 100 studies. The mean effect size on attitude for subjects given a tangible reward was slightly positive but once outliers were removed, the mean did not differ significantly from 0.00.

In summary, subjects rewarded with verbal praise or positive feedback show significantly greater intrinsic motivation than non-rewarded subjects. Those who receive a tangible reward evidence significantly less intrinsic motivation than non-

rewarded subjects as measured by time on task, but do not differ in their reports of task interest or enjoyment.

The next step in the analysis involves a further breakdown of the effects of tangible reward. The goal is to identify variables that may moderate the effects of tangible reward on intrinsic motivation and to establish within-group homogeneity. One factor that may impact effect size is whether the rewards implemented in the studies were promised to subjects prior to the experimental sessions or whether they were received unexpectedly.

Reward Expectancy

Within the intrinsic motivation literature, researchers draw a distinction between 'expected' and 'unexpected' reward. Expected rewards refer to a procedure whereby subjects are offered a reward prior to the experimental session and delivered the reward following the session. Subjects who receive an unexpected reward have not been promised the reward beforehand. These terms are generally used to describe procedures involving the administration of 'tangible' rewards.

In most studies on verbal reward, praise was delivered unexpectedly and was not contingent on any specified level of performance. The few studies on verbal reward that did employ expected and/or contingency procedures did not produce effect sizes that deviated much from the mean effect size presented in Table 3.3. For this reason, no further subdivision of effect sizes from verbal reward studies was undertaken. The following analyses concern the effects of tangible reward. Results are displayed in Table 3.4.

Table 3.4
Effect size as a function of reward expectancy for tangible reward versus control comparisons

Free Time on Task
Tangible Reward vs Control

Reward Expectancy	Analysis	k	Sample size	Mean weighted d	95% C.I for d	Q	CL
Unexpected	All known effects	6	275	+0.01	-0.24 to 0.25	7.38	.50
Expected	All known effects	50	2825	-0.23	-0.30 to -0.15	185.48*	.44
Expected	Outliers removed using Tukey's procedure	46	2603	-0.25	-0.33 to -0.17	101.36*	.43
Expected	Additional outliers removed	42	2408	-0.25	-0.33 to -0.16	64.78	.43

Attitude
Tangible Reward vs Control

Reward Expectancy	Analysis	k	Sample size	Mean weighted d	95% C.I for d	Q	CL
Unexpected	All known effects	5	311	+0.06	-0.16 to 0.28	12.42	.52
Expected	All known effects	35	2126	+0.10	0.01 to 0.19	135.26 *	.53
Expected	Outliers removed using Tukey's procedure	32	1961	+0.07	-0.02 to 0.16	50.48	.52

Note. Negative effect sizes indicate a decrease in intrinsic motivation for reward/reinforcement groups; positive effect sizes indicate an increase. k = number of effect sizes; Sample size = sum of n in all studies; Mean weighted d = mean of weighted effect sizes (weighted by sample size); C.I. = confidence interval; Q = homogeneity statistic for mean effect sizes, CL = common language effect size statistic.
* Significance indicates rejection of the hypothesis of homogeneity.
* $p < .01$

Only six studies assessed the effects of unexpected tangible reward on the time measure of intrinsic motivation; five studies investigated attitude. The average effect sizes for unexpected tangible reward versus control groups on free time and attitude were slightly positive but did not differ from 0.00. These results indicate that subjects

receiving an unexpected reward do not differ significantly from non-rewarded control subjects on measures of intrinsic motivation.

For the expected tangible reward versus control comparisons, expected reward subjects demonstrated significantly less intrinsic motivation on the free time measure. On attitude, when homogeneity was attained, the two groups did not differ.

In the following section of this chapter, studies comparing expected tangible reward groups to non-rewarded controls were further subdivided into groups based on reward contingency.

Reward Contingency

In some studies, subjects were promised a tangible reward that was delivered for participating in the study or for engaging in a specific task. This type of reward procedure is referred to as non-contingent. In other studies, tangible reward was offered for solving a puzzle, completing a task and/or attaining a certain level of performance. Reward administered in this manner is referred to as contingent reward. Box plots of effect sizes for the two types of comparisons on both the free time and attitude measures are shown in Figure 3.3.

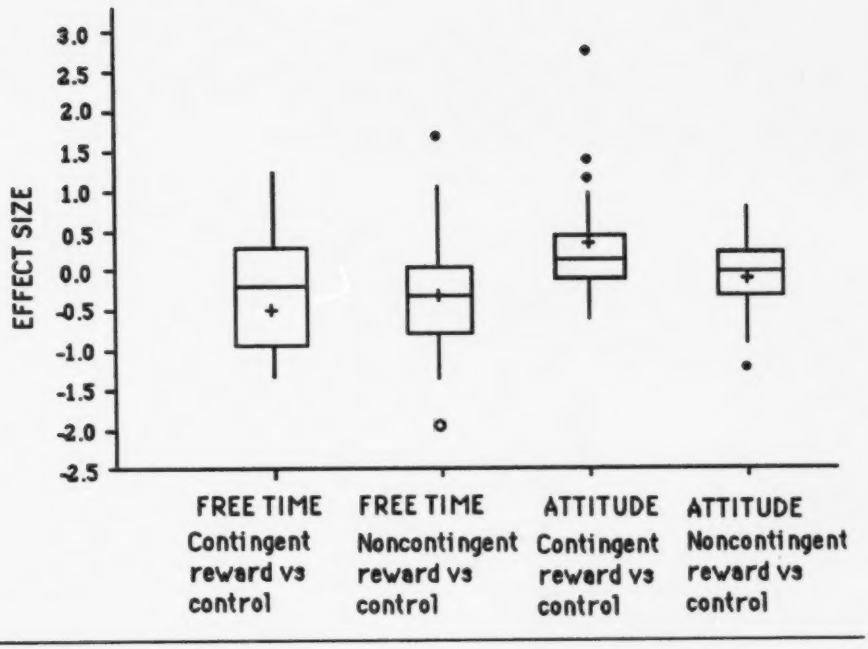

Figure 3.3.
Box plots of effect sizes for two types of comparisons of expected tangible reward versus control groups on two measures of intrinsic motivation (+ = sample mean, o = outlier)

On the free time measure, the median of effect sizes for both contingent and non-contingent comparisons is slightly below 0.00. On the attitude measure, the bulk of effect sizes for expected contingent tangible reward versus control groups lie above 0.00. The majority of studies investigating non-contingent rewards versus controls fall below 0.00. Table 3.5 presents results from the meta-analysis of these comparisons.

Table 3.5
Effect size as a function of reward contingency for expected tangible reward versus control comparisons

Free Time on Task
Expected Tangible Reward vs Control

Reward Contingency	Analysis	k	Sample size	Mean weighted d	95% C.I for d	Q	CL
Contingent	All known effects	20	976	-0.11	-0.24 to 0.02	41.46 *	.47
Contingent	Outliers removed	18	931	-0.12	-0.25 to 0.01	33.09	.47
Non-contingent	All known effects	39	1977	-0.29	-0.38 to -0.19	162.47*	.42
Non-contingent	Outliers removed using Tukey's procedure	37	1854	-0.27	-0.37 to -0.17	96.51 *	.42
Non-contingent	Additional outliers removed	33	1688	-0.28	-0.38 to -0.18	50.25	.42

Attitude
Expected Tangible Reward vs Control

Reward Contingency	Analysis	k	Sample size	Mean weighted d	95% C.I for d	Q	CL
Contingent	All known effects	20	1224	+0.24	0.12 to 0.36	88.64 *	.57
Contingent	Outliers removed using Tukey's procedure	17	1087	+0.11	-0.01 to 0.23	22.24	.53
Non-contingent	All known effects	17	913	-0.04	-0.17 to 0.09	50.14 *	.49
Non-contingent	Outliers removed using Tukey's procedure	16	853	+0.03	-0.10 to 0.17	31.52 *	.49
Non-contingent	Additional outliers removed	15	833	+0.05	-0.08 to 0.19	27.91	.48

Note. Negative effect sizes indicate a decrease in intrinsic motivation for reward/reinforcement groups; positive effect sizes indicate an increase. k = number of effect sizes; Sample size = sum of n in all studies; Mean weighted d = mean of weighted effect sizes (weighted by sample size); C.I. = confidence interval; Q = homogeneity statistic for mean effect sizes, CL = common language effect size statistic.
* Significance indicates rejection of the hypothesis of homogeneity.
* $p < .01$

Table 3.5 indicates that when subjects who are promised a tangible reward for attaining a specified level of performance on a task (contingent reward) are compared to non-rewarded controls, no significant differences emerge on either measure of intrinsic motivation. Subjects who receive an expected non-contingent reward show significantly less intrinsic motivation than controls as measured by time on task once reward is withdrawn. On attitude, they show greater intrinsic motivation, but this difference is not significant.

In summary, these results suggest that rewarded subjects spend less time on a task following the removal of a reward than control subjects when the reward is tangible, expected (promised), and non-contingent. This same condition, however, does not produce less interest, satisfaction, or enjoyment of the task.

Additional Analyses

A few researchers have assessed the effects of expected tangible rewards on intrinsic motivation relative to unexpected tangible rewards. Other researchers have conducted studies comparing expected non-contingent reward groups to expected contingent reward groups. Such studies concern direct comparisons between the two types of reward expectancies (expected versus unexpected) and the two types of reward contingencies (non-contingent versus contingent) without reference to a non-rewarded control group.

Effect sizes from these comparisons were assessed with two analyses: a) inclusion of studies comparing expected tangible reward groups to unexpected tangible reward groups on the free time and attitude measures of intrinsic motivation, and b) inclusion of studies comparing expected non-contingent tangible rewards to expected contingent tangible rewards on the free time and attitude measures of intrinsic motivation. Results from these analyses, a summary of the coded studies, and a list of the studies included in the analyses is given in Appendix C. One significant effect

emerged from these analyses; subjects who received an expected tangible reward showed less intrinsic motivation on the free time measure than subjects who received an unexpected reward. The average effect size and confidence interval for this comparison was -0.26 (-0.45, -0.06). It is interesting to note that the effect size of -0.26 is almost identical to the effect size of -0.25 derived from a comparison of expected tangible reward groups to non-rewarded controls.

Results from Single-subject Designs

To determine the effects of 'reinforcement' on intrinsic motivation, an analysis was conducted on effect sizes from single-subject, repeated-measure designs where the rewards used were shown to be reinforcers for each subject in the study. That is, rewards were shown to increase behavior during a reinforcement phase. An increase or decrease in intrinsic motivation was measured as a difference between behavior during the pre- and post-reinforcement phases. Five studies contributed an effect size to this analysis. Four studies showed that subjects spent more time on the task during the post-reinforcement phase than the baseline phase. One study (Vasta & Stirpe, 1979) showed a decrease in time on task immediately following the removal of reward but an increase in time when intrinsic motivation was measured two weeks later. To make this analysis comparable to the analysis of group design studies, however, only differences between the immediate post-reinforcement phase and baseline were analyzed.

The average effect size and confidence interval for this analysis was +0.34 (-0.28, 0.96) indicating no significant change in intrinsic motivation from baseline to post-reinforcement phases. Effect sizes were homogeneous ($Q = 2.96$, $df = 4$). These results suggest that 'reinforcement' does not alter people's intrinsic motivation.

Discussion

A major contention in psychology and education is that rewards/reinforcement negatively impact a person's intrinsic motivation. The view is that if people are reinforced/rewarded for activities they already spend time on and enjoy, they will be less motivated to engage in the activity than they were prior to the introduction of reward, once the reward is no longer forthcoming. In other words, rewards/reinforcement are said to decrease people's intrinsic motivation.

Over the past twenty years, dozens of studies have been conducted to investigate this issue. The primary objective of this chapter was to assess the research findings by conducting a meta-analysis of results from experiments on the effects of reward/reinforcement on intrinsic motivation. What follows is a summary and discussion of the results obtained from the meta-analysis.

One analysis was conducted using single-subject, repeated measures designs. A few researchers employed this type of design to evaluate the effects of 'reinforcement' on intrinsic motivation. The rewards used in these studies were shown to be reinforcers and intrinsic motivation was indexed as differences in subjects' behavior between pre- and post-reinforcement sessions. Results from the meta-analysis indicate no effect of 'reinforcement' on intrinsic motivation. That is, the evidence suggests that reinforcement does not decrease a person's intrinsic motivation to engage in an activity.

The vast majority of studies have assessed the effects of 'reward' on intrinsic motivation by using group designs. Rewarded subjects are compared to non-rewarded controls. Intrinsic motivation is measured by differences between groups on attitude, time spent on a task following the removal of reward, and willingness to volunteer for future studies without reward. The main meta-analysis reported in this chapter was conducted on results from these studies. This analysis concerned assessing the overall

effects of reward on intrinsic motivation as well as the effects of a number of reward characteristics. A summary of the various analyses conducted and the major findings is given in Figure 3.4.

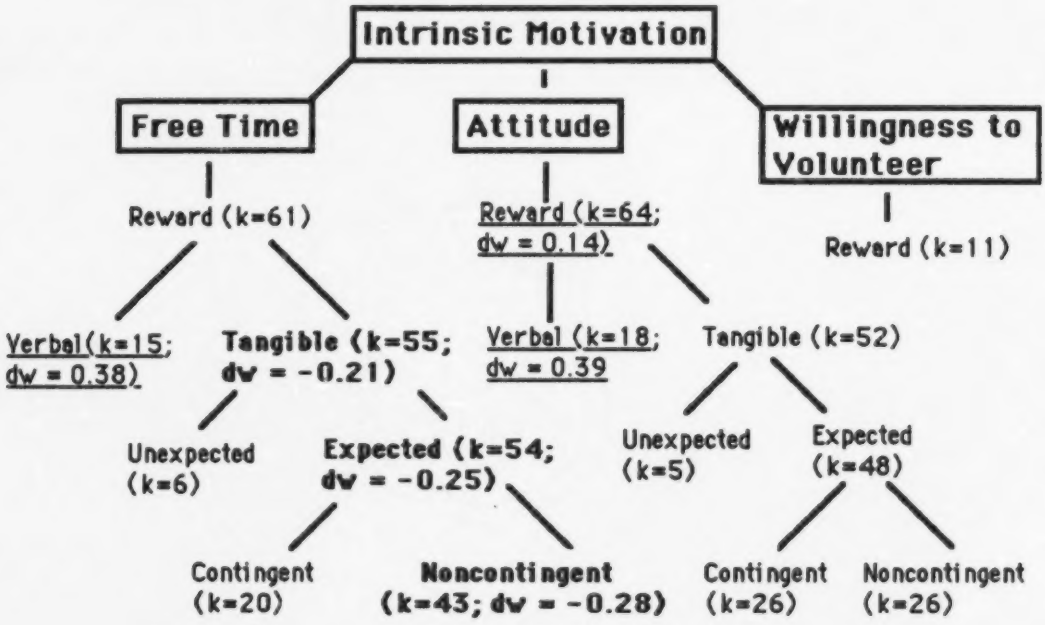

Figure 3.4. A summary of the meta-analyses of the effects of reward vs control groups on intrinsic motivation

Note. k = total number of studies; dw = mean weighted effect size (based on homogeneous samples); analyses typed in plain text indicate no effect, analyses typed in **bold** text indicate a negative effect, underlined analyses indicate a positive effect. When no dw is reported, there was no significant effect.
k's do not sum up because analyses may represent studies in which more than one type of reward group was averaged with another.

When all types of reward are aggregated, overall, the results suggest that reward does not negatively affect intrinsic motivation. Rewarded subjects do not spend significantly less time on a task once the reward is withdrawn than non-rewarded subjects. Nor are they less willing to volunteer for future projects without reward.

When intrinsic motivation is measured by self reports of task interest, satisfaction, and enjoyment, rewarded persons report a more positive attitude than non-rewarded individuals.

These findings run contrary to the views expressed by many psychologists and educators (e.g., Deci & Ryan, 1985; Levine & Fasnacht, 1974; Schwartz, 1990). For example, Deci and Ryan (1987) state that:

> "*In general*, rewards have been found to undermine intrinsic motivation. When people received rewards for working on an interesting activity, they tended to display less interest in and willingness to work on that activity after the termination of the rewards than did people who had worked on the activity without receiving a reward" (p.1026). (emphasis mine)

Results from the present meta-analysis suggest that this statement is erroneous. Not only do the findings indicate that, *in general*, rewarded people are not less willing to work on activities; the results clearly show that in many cases, rewarded individuals display a more favorable attitude toward tasks than do people who do not receive rewards.

Analyses for the effects of reward type (verbal, tangible), reward expectancy (unexpected, expected), and reward contingency (contingent, non-contingent) are presented in Figure 3.4. The findings demonstrate that verbal praise has an enhancing effect on intrinsic motivation on both the free time and attitude measures. People who receive a verbal reward spend more time on a task once the reward is withdrawn and show more interest and enjoyment than non-rewarded persons.

Tangible reward produced a negative effect on the time on task measure when the reward was expected and non-contingent. That is, individuals who were offered a reward simply for participating in the study or engaging in the task spent less time on the task following the removal of reward than did people who did not receive a reward. Subjects did not report less interest, satisfaction, or enjoyment of the task.

Other analyses produced no significant effects. Results indicate that unexpected reward does not lead to a decrease in intrinsic motivation. Furthermore, when individuals receive an expected reward for solving or completing a task, or for attaining a specific level of performance, their intrinsic motivation is not affected.

Given these results, why is it that one commonly finds general statements condemning reinforcement and/or reward in journal articles and introductory textbooks? An examination of Figure 3.4 makes it clear how circumscribed the negative effect really is. One possibility is that terms such as tangible, expected, unexpected, contingent and non-contingent become very confusing to a reader sorting through this literature. Consider, at its simplest, a study investigating the effects of 'expected' reward on intrinsic motivation. Suppose the results showed a negative effect for expected reward. When discussing findings, do the researchers talk about the negative effects of the 'promise' of reward or about the negative effects of reward, in general? There is no doubt that conclusions reached from such studies are often made about reward or reinforcement in general, not promise of reward. This has led to a great deal of misunderstanding about the overall effects of reward/reinforcement on intrinsic motivation. Even an informed reader can have difficulty keeping in mind what a particular study is investigating. It may be for this reason that rewards, overall, have come to be seen as harmful. It is hoped that the present meta-analysis has helped to clarify the issue.

Results from the meta-analysis revealed that reward produces negative effects under a limited set of circumstances. The reward must be promised (expected) and delivered regardless of one's performance on a task (non-contingent). Under these conditions, rewarded individuals spend less time on a task when the reward is terminated than non-rewarded persons. They do not, however, enjoy the task any less. It is interesting to note the number of studies that have been conducted on the various reward characteristics. The total number of studies for each analysis is portrayed in

Figure 3.4. When studies are broken down into reward type, expectancy, and contingency, one can see that most studies have assessed the effects of expected non-contingent tangible reward on the free time measure of intrinsic motivation. In other words, the major focus of the research has been in the one area where a negative effect is demonstrated.

Theoretical Implications

How do results from the present meta-analysis fit in with the various theories that have been formulated to account for the negative effects of rewards on intrinsic motivation?

Advocates of cognitive evaluation theory (e.g., Deci & Ryan, 1985) would probably not have difficulty reconciling results from the free time measure of intrinsic motivation. According to cognitive evaluation theory, competence and self-determination underlie intrinsic motivation. Rewards can facilitate or hinder competence and self-determination depending on whether they are perceived as informational, controlling, or amotivational. From this perspective, results from the meta-analysis would suggest that verbal rewards increase a person's intrinsic motivation because of their informational value. Verbal praise would be seen to lead an individual to feel competent in performing a task; hence, intrinsic motivation would increase. Since the cognitive evaluation process is said to take place while the rewarded activity is occurring, unexpected rewards would not alter a person's intrinsic motivation. On the other hand, rewards offered to people for participating in a task, in spite of how well they perform, would be perceived as controlling and would decrease intrinsic motivation.

The problem for cognitive evaluation theory arises when one considers results from the attitude measure of intrinsic motivation. Deci and Ryan (1985) suggest that interest, enjoyment, and satisfaction are central emotions that accompany intrinsic

motivation. A person's experience of an activity is a focal point of cognitive evaluation theory. In other words, cognitive evaluation theory depends on an internal attitude change that is later expressed behaviorally as time on task. Thus, the meta-analysis results from the attitude measure are central to understanding the effects of reward on intrinsic motivation. Results indicate that reward does not negatively affect attitude. Individuals who receive verbal praise report greater interest than non-rewarded people. Tangible rewards produce no changes in attitude. Since cognitive evaluation theory depends on an attitude change to account for changes in the free time behavior, results from the present meta-analysis may be difficult to reconcile.

Another theoretical explanation that has been proposed to account for the effects of rewards on intrinsic motivation is the 'overjustification' effect (Lepper, Greene & Nisbett, 1973). The view is that people's perceptions about the causes of their behavior influence future motivation. Rewards lead to a decrease in intrinsic motivation when people's perceptions shift from accounting for their behavior as self-initiated to accounting for it in terms of external reward. Since the present analysis did not evaluate subjects' perceptions about the causes of their behavior, it is impossible to determine whether overjustification explains the results.

Finally, how would the findings of the meta-analysis be interpreted from a behavioral perspective? The results from single-subject designs indicate that 'reinforcement' does not produce decrements in intrinsic motivation. This finding is compatible with a behavioral view. That is, behaviorists maintain that behavior returns to baseline after reinforcement is withdrawn. If the rewards used in the groups design studies are reinforcers, one would expect behavior to eventually return to baseline. Research designed to investigate the effects of 'reward' on intrinsic motivation has typically measured time on task for a brief 8 to 10 minute period, immediately following the removal of reward. Thus, if verbal praise were a reinforcer, one might interpret the positive effect as a carry over of the reinforcement procedure. After a

period of time, behavior would return to baseline. In terms of the negative effect of expected, non-contingent, tangible reward, some writers (e.g., Dickinson, 1989; Flora, 1990) have suggested that such a reward procedure does not represent a reinforcement contingency. The promise of a reward is seen by behaviorists as a discriminitive stimulus (S^D) and the negative effect is understood as the result of a bribe.

The present meta-analysis was not designed to test the adequacy of any of these theories. Nonetheless, it is interesting to surmise how the results would be conceptualized in terms of differing theoretical perspectives. Importantly, the implication of the results is that there is little reason to theorize about the negative effects of reward/reinforcement on intrinsic motivation. This is because reinforcement does not negatively impact intrinsic motivation and, in most cases, reward also does not produce a detrimental effect.

One issue, however, that is not resolved here, concerns the whole notion of intrinsic motivation. A major difficulty with the concept 'intrinsic motivation' is that it is defined by default. This means that no matter how intrinsic motivation is measured, one can always argue that such a measure does not adequately assess the concept. As long as this is the case, intrinsic motivation will remain a philosophical issue rather than an empirical one.

Practical implications

Results from the present meta-analysis indicate that, overall, rewards/reinforcement do not harm a person's intrinsic motivation. These findings have practical importance for business managers, clinicians, educators, and so on. The implication is that incentive systems based on tokens, money, etc. in the school or workplace will not lead people to lose interest in their work. Furthermore, once the rewards are terminated, people will continue to spend as much time on activities as they did prior to the introduction of incentives.

Importantly, verbal praise and positive feedback enhance people's intrinsic interest. One circumstance in which incentives negatively affect motivation is when rewards are offered to people for engaging in a task without consideration of any standard of performance. In such a case, one could expect rewarded individuals to enjoy the task as much as those who are not offered an incentive. But, they will spend less time on the activity when the reward is no longer forthcoming. One might ask how serious this effect would be.

Results from the meta-analysis indicate that the average effect size for a comparison between people who receive an expected, tangible, non-contingent reward to non-rewarded individuals on time on task following the withdrawal of reward is -0.28. In the original experiments, time on task was typically measured over an eight-minute period. In order to convert the effect size of -0.28 to real time, one needs to know the pooled standard deviation of rewarded and non-rewarded groups. One way to estimate the pooled standard deviation is look at the original studies. Since many researchers reported only t or F statistics, one article (Pretty & Seligman, 1984) that documented two separate studies was chosen to estimate a pooled standard deviation.

The studies presented in Pretty and Seligman's (1984) article were well controlled, clearly described, and statistical information was readily available. Both studies involved a comparison of thirty expected, tangible, non-contingent reward subjects to thirty non-rewarded controls on an eight-minute free time measure of motivation. The pooled standard deviation for these studies was 2.5 and 2.7 minutes. Suppose one were to take the average of these numbers and estimate the overall pooled standard deviation of rewarded and control groups to be 2.6 minutes. An effect size of -0.28 would mean that in an eight-minute period, the average individual who is offered a non-contingent, tangible reward would spend 43.7 seconds less time on the task than the average non-rewarded individual once the reward was removed. This would translate to 5 minutes, 46 seconds in a one hour period. Recall that the average effect

size for verbally rewarded subjects was +0.38 on the free time measure. Using the pooled standard deviation of 2.6, one could estimate that in an eight-minute period, the average subject receiving verbal praise would spend 59.3 seconds longer on a task than non-rewarded subjects following the withdrawal of praise. In a one hour period, this converts to 7 minutes, 25 seconds. Of course, this is a hypothetical example but it does illustrate the magnitude of effect size in terms of real time[2]. On a practical level, the results clearly indicate that rewards, reinforcement, and incentives are not harmful to one's intrinsic motivation.

Conclusion

The meta-analysis presented in this chapter was designed to investigate the effects of reward/reinforcement on intrinsic motivation. The evidence does not support the view that reward/reinforcement leads to decreased intrinsic motivation. Nonetheless, this is a prominent view that has permeated much of the theoretical and practical literature in psychology. As a result, there are many pedagogical practices that have been altered on the basis of this view. For these reasons, the next chapter concerns an examination of the social and historical context in which this literature was instigated and such conclusions were readily accepted.

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[2] Results from Pretty & Seligman's (1984) article indicated that in Experiment 1, subjects who received an expected, tangible, non-contingent reward spent 2 minutes less time on the task than non-rewarded subjects; verbally praised subjects spent 57 seconds longer than control subjects. In Experiment 2, subjects who received an expected, tangible, non-continent reward spent 19 seconds less time than controls.

Table 3.6
Characteristics of studies included in the meta-analysis

Author(s)	Journal	Design	Subjects	Task	Reward Type	Expect-ancy	Contin-gency	Dep. measure	N Exp.	N Control	Effect size (g)[a,b]
Deci (71) Exp. 1	JPSP	B/A	adults	Soma	T	E	cont	free time	12	12	-0.54
"	"	"	"	"	"	"	"	attitude	12	12	0.00 [a]
Deci (71) Exp. 3	JPSP	B/A	adults	Soma	V	U	not	free time	12	12	+0.82
"	"	"	"	"	"	"	"	attitude	12	12	0.00 [a]
Kruglanski et al (71)	J of Pers.	A/O	15-16 yrs	creativity & recall	T	E	not	attitude	16	16	-0.69
"	"	"	"	"	"	"	"	volunteer	16	16	-0.63
Deci (72a)	JPSP	A/O	adults	Soma	V	U	not	free time	48	48	+0.29
"	"	"	"	"	T	E	cont (1)	free time	32	32	+0.75
"	"	"	"	"	T	E	cont (2)	free time	32	32	-0.10
Deci (72b)	Org Beh & Hum Perf	A/O	adults	Soma	T	E	not	free time	24	16	+0.08 [b]
Kruglanski et al (72)	J. Exp. Soc Psych	A/O	children	5 games	T	U	cont	attitude	36	33	-0.66
Lepper et al (73)	JPSP	B/A	children	drawing	T	E	not cont	free time	18	15	-0.72
"	"	"	"	drawing	T	U	not cont	free time	18	15	+0.57 [b]
Greene, Lepper (74)	Child Dev	A/O	children	drawing	T	E	not	free time	15	15	-0.70
"	"	"	"	"	T	E	cont	free time	15	15	-0.57

"	"	"	"	"	T	U	not	free time	13	15	+0.06
"	"	"	"	"	T	U	cont	free time	13	15	+0.22
Ross (75) Exp. 1	JPSP	A/O	children	playing drum	T	E	not (1)	free time	20	20	-0.54
"	"	"	"	"	T	E	not (2)	free time	20	20	+0.56
Ross (75) Exp. 2	JPSP	A/O	children	drum	T	E	not	free time	52	14	-0.81
Taub, Dollinger (75)	J of Pers	A/O	children	coding	T	E	cont	attitude	124	124	0.00 [a]
Kruglanski et al (75) Exp. 1	JPSP	A/O	14-15 yr. olds	2 tasks	T	E	cont	attitude	24	24	+1.15
Kruglanski et al (75) Exp 2	JPSP	A/O	15-16 yr. olds	2 tasks	T	E	cont	attitude	40	40	+0.39
Reiss, Sushinski (75)	JPSP	A/O	children	listening to songs	T	E	not	free time	16	16	-0.84
Salanick (75)	Org Beh & Hum Perf	A/O	adults	train game	T	E	cont	free time	38	39	-0.12 [b]
"	"	"	"	"	"	"	"	attitude	38	39	-0.01 [b]
Hamner, Foster (75)	Org Beh & Hum Perf	A/O	adults	scoring questions	T	E	not	attitude	31	30	-0.23
"	"	"	"	"	T	E	cont	attitude	37	30	+0.19
Calder, Staw (75)	JPSP	A/O	adults	puzzles	T	E	not	attitude	20	20	+0.22 [b]
"	"	"	"	"	"	"	"	volunteer	20	20	+0.28

Feingold, Mahoney (75)	Behavior Therapy	SS repeated measures	children	dot-to-dot connec-tions	T	E	cont	# of connec-tions	5	—	+0.34
Anderson et al (76)	JPSP	B/A	children	drawing	V	U	not	free time	18	46	+1.07
"	"	"	"	"	T	E	not	free time	36	46	+0.04
Arnold (76)	Org Beh & Hum Perf	multiple trials	adults	computer game	T	E	not	attitude	17	36	0.00 [a]
"	"	"	"	"	"	"	"	volunteer	17	36	+0.02
Ross et al (76)	JPSP	A/O	children	drawing	T	E	not (1)	free time	12	12	-0.64
"	"	"	"	"	T	E	not (2)	free time	12	12	+0.44
Shapira (76)	JPSP	A/O	adults	Soma	T	E	cont	attitude	30	30	+0.41 [b]
Swann, Pittman (77) Exp. 1	Child Dev	A/O	children	drawing	T	E	not	free time	40	20	-0.42 [b]
Swann, Pittman (77) Exp. 2	Child Dev	A/O	children	drawing	T	E	not	free time	39	26	-0.15 [b]
Karniol, Ross (77)	Child Dev	A/O	children	slide show	T	E	not	free time	17	20	-0.04
"	"	"	"	"	T	E	cont	free time	20	20	+0.15
Pittmann et al (77)	Per & Soc Psy Bull	A/O	adults	gravi-tation	T	E	cont	attitude	60	20	-0.20
Mynatt et al (78)	Cog Ther & Res	B/A mult trials	children	educ games	T	E	not	free time	10	10	+1.01
Weiner, Mander (78)	Mot & Emotion	A/O	adults	decoding cartoons	T	E	not	free time	20	30	-0.34

"	"	"	"	"	"	"	cont	free time	30	30	-0.54
"	"	"	"	"	"	"	not	attitude	30	30	0.00 [a]
"	"	"	"	"	"	"	cont	attitude	30	30	0.00 [a]
Orlick, Mosher (78)	Int J. of Sport Psy	B/A	children	stabilo-meter	T	E	cont	free time	14	12	-0.34
"	"	"	"	"	T	U	not	free time	12	12	-0.82
"	"	"	"	"	V	U	not	free time	11	12	-0.22
Smith, Pittman (78)	JPSP	A/O	adults	Labyrinth	T	E	cont	attitude	66	33	-0.10 [b]
Dollinger, Thelan (78)	JPSP	A/O	children	mazes	T & V	E	both	attitude	48	12	0.00 [a]
Davidson, Bucher (78)	Behavior Therapy	SS repeated measures	children	playing with clown	T	E	not	# of responses	3	—	+1.83
Vasta et al (78)	J of School Psych	SS repeated measures	children	coloring	T & V	U	not	time	6	—	+0.74
Arkes (79)	Mot & Emotion	A/O	adults	Soma	T	E	cont	free time	32	32	-0.16
"	"	"	"	"	"	"	"	attitude	32	32	+0.03
Loveland, Olley (79)	Child Dev	A/O	children	drawing	T	E	not	free time	12	12	0.00
Harackiewicz (79)	JPSP	B/A	16 yr. olds	hidden puzzles	V	U	not	attitude	31	31	+0.59
"	"	"	"	"	T	E	not	attitude	31	31	-0.38

McLoyd (79)	Child Dev	A/O	children	reading books	T	E	cont	free time	36	18	-0.22
Wimperis, Farr (79)	J. Applied Soc Psych	A/O	adults	erector sets	T	E	not	attitude	16	16	+0.56
"	"	"	"	"	T	E	cont	attitude	16	16	+1.36
"	"	"	"	"	T	E	both	volunteer	32	16	+0.69
Weinberg, Jackson (79)	Research Quarterly	A/O	adults	stabilo-meter	T	E	cont	attitude	40	40	0.00 [a]
McGaw, McCullers (79)	J Expt. Soc Psych	A/O	adults	water jar problem	T	E	cont	attitude	20	20	-0.04
"	"	"	"	"	"	"	"	volunteer	18	17	-0.43 [b]
Vasta, Stirpe (79)	Behavior Mod	SS repeated measures	children	math problems	T	E	not	time	4	---	-0.46
Brennan, Glover (80)	Soc Beh & Pers	B/A	adults	Soma	T	E	not	free time	19	39	+1.06
Weiner (80)	J of Soc Psych	A/O	adults	anagrams	T	E	cont	attitude	24	24	0.00 [a]
"	"	"	"	"	"	"	"	volunteer	24	24	0.00 [a]
Rosenfield et al (80)	JPSP	A/O	adults	Ad Lib	V	E	cont	free time	30	59	+0.48
"	"	"	"	"	"	"	"	attitude	30	59	-0.64
"	"	"	"	"	"	"	"	volunteer	30	59	-0.76
"	"	"	"	"	T	E	cont	free time	30	27	+0.65

"	"	"	"	"	"	"	"	attitude	30	27	+2.80
"	"	"	"	"	"	"	"	volunteer	30	27	+0.27
Staw et al (80)	J of Pers	A/O	adults	puzzles	T	E	not	attitude	47	46	+0.19
"	"	"	"	"	"	"	"	volunteer	47	46	+0.34
Williams (80)	JPSP	B/A mult trials	children	4 games	T	E	not	free time	24	24	-0.32
"	"	"	"	"	"	"	"	attitude	24	24	0.00 [a]
Daniel, Esser (80)	J Applied Psych	A/O	adults	puzzles	T	E	cont	free time	32	32	-0.52
"	"	"	"	"	"	"	"	attitude	32	32	-0.19 [b]
"	"	"	"	"	"	"	"	volunteer	32	32	+0.08
Morgan (81) Exp 1	JPSP	A/O	children	puzzles	T	E	not	free time	27	27	-0.98
"	"	"	"	"	"	"	"	attitude	27	27	-0.31
Morgan (81) Exp 2	JPSP	A/O	children	puzzles	T	E	not	free time	20	20	-0.77
"	"	"	"	"	"	"	"	attitude	20	20	+0.04
Brockner, Vasta (81)	J of Res in Pers	A/O	adults	Soma	T	E	cont	free time	26	26	-0.37
"	"	"	"	"	"	"	"	attitude	25	26	-0.58
Pittman et al (80)	Pers & Soc Psych Bull	A/O	adults	Soma	V	U	not	free time	24	12	+0.80
Shanab et al (81)	J of Soc Psych	A/O	adults	Soma	V	U	not	free time	20	20	+0.64

"	"	"	"	"	"	"	"	attitude	20	20	+0.43
Danner, Lonkey (81)	Child Dev	A/O	children	class inclusion	T	E	not	free time	30	30	-1.33
"	"	"	"	"	"	"	"	attitude	30	30	-1.23
"	"	"	"	"	V	U	not	free time	30	30	-0.10
"	"	"	"	"	"	"	"	attitude	30	30	-0.08
Boal, Cummings (81)	Org Beh & Hum Perf	field study	adults	coding data	T	E	not	free time	21	22	+1.64
"	"	"	"	"	T	E	cont	free time	21	22	+0.38
Luyten, Lens (81)	Mot & Emotion	A/O	adults	wood models	T	E	not	free time	10	10	-0.96
"	"	"	"	"	"	"	"	attitude	10	10	-0.88
"	"	"	"	"	"	"	"	volunteer	10	10	-1.15
"	"	"	"	"	T	E	cont	free time	10	10	-0.91
"	"	"	"	"	"	"	"	attitude	10	10	+0.08
"	"	"	"	"	"	"	"	volunteer	10	10	+1.08
Boggiano et al (82)	Social Cognition	A/O	children	hidden pictures	T	E	not	free time	81	84	+0.28
Zinser et al (82)	J General Psych	A/O	children	hidden pictures	V	U	cont	free time	64	32	+0.08
Porac, Meindl (82)	Org Beh & Hum Perf	A/O	adults	Soma	T	E	not	free time	40	20	-0.21

Earn (82)	J of Pers	A/O	adults	anagrams	T	E	not	free time	40	20	-0.28
"	"	"	"	"	"	"	"	attitude	40	20	+0.18
Pittman et al (82) Exp 1	JPSP	A/O	children	matching games	T	E	not	free time	20	10	+0.31
"	"	"	"	"	"	"	"	attitude	20	10	0.00 [a]
Pittman et al (82) Exp 2	JPSP	A/O	children	drawing	T	E	not	free time	28	28	-0.05
Pallack et al (82)	Child Dev	A/O	children	drawing	V	U	not	free time	14	12	-0.48
"	"	"	"	"	V	E	not	free time	14	12	+0.32
"	"	"	"	"	T	U	not	free time	15	12	-0.44
"	"	"	"	"	T	E	not	free time	15	12	-0.16
Crino, White (82)	J Management	A/O	adults	puzzles	V	U	cont	attitude	20	10	+0.01
"	"	"	"	"	"	"	"	volunteer	20	10	+0.49
"	"	"	"	"	V	U	not	attitude	20	10	+0.07
"	"	"	"	"	"	"	"	volunteer	20	10	+0.64
Ogilvie, Prior (82)	Aust & N.Z J Dev. Dis.	B/A	children	drawing	T	E	not	free time	26	26	-0.08
Boggiano, Hertel (83)	Social Cognition	A/O	adults	memory task	T	U	not	attitude	46	46	+0.02
Ryan et al (83)	JPSP	A/O	adults	hidden puzzles	T	E	cont	free time	32	32	-0.46

"	"	"	"	"	"	"	"	attitude	32	32	0.00 [a]
"	"	"	"	"	T	E	not	free time	16	16	-0.35
"	"	"	"	"	"	"	"	attitude	16	16	0.00 [a]
"	"	"	"	"	V	E	not	free time	64	32	+0.47
"	"	"	"	"	"	"	"	attitude	64	32	0.00 [a]
Morgan (83) Exp 1	Child Dev	A/O	children	puzzles	T	E	not	free time	40	40	-1.94
"	"	"	"	"	"	"	"	attitude	40	20	-0.27 [b]
Morgan (83) Exp 2	Child Dev	A/O	children	puzzles	T	E	not	free time	40	40	-0.59
"	"	"	"	"	"	"	"	attitude	20	20	0.00
Vallerand (83)	J Sport Psych	A/O	children	slideshow game	V	E	not	attitude	40	10	+1.98
DeLoach et al (83)	Bull Psych Society	B/A	children	connect dots	T	E	not	free time	26	26	0.00 [a]
Blanck et al (84)	Sex Roles	A/O	adults	word game	V	U	not	free time	70	69	+0.56
"	"	"	"	"	"	"	"	attitude	70	69	+0.46
Sarafino (84)	Br. J Dev Psych	A/O	children	riddles	T	E	not	free time	85	15	-0.41
"	"	"	"	"	"		"	attitude	85	15	0.00 [a]
Harackiewicz et al (84)	J Exp. Psych	A/O	16 yr olds	hidden puzzles	T	E	cont	attitude	47	47	+0.33

Griffith et al (84)	Bull Psych Society	A/O	children	reading books	T	E	not	free time	64	32	0.00 [a]
Pretty, Seligman (84) Exp 1	JPSP	B/A	adults	Soma	T	E	not	free time	30	30	-0.75
"	"	"	"	"	"	"	"	attitude	30	30	-0.05
"	"	"	"	"	T	U	not	free time	30	30	+0.06
"	"	"	"	"	"	"	"	attitude	30	30	+0.42
"	"	"	"	"	V	U	not	free time	30	30	+0.35
"	"	"	"	"	"	"	"	attitude	30	30	+0.46
Pretty, Seligman (84) Exp. 2	JPSP	B/A	adults	Soma	T	E	not	free time	30	30	-0.13
"	"	"	"	"	"	"	"	attitude	30	30	-0.16
"	"	"	"	"	T	U	not	free time	30	30	+0.06
"	"	"	"	"	"	"	"	attitude	30	30	+0.38
Harackiewicz et al (84) Exp 1	JPSP	B/A	adults	pinball	T	E	cont	free time	32	32	+0.07
"	"	"	"	"	"	"	"	attitude	32	32	+0.03
Harackiewicz et al (84) Exp 2	JPSP	B/A	adults	pinball	T	E	cont	attitude	15	15	+0.18
"	"	"	"	"	T	U	cont	attitude	15	15	+0.15
Harackiewicz et al (84) Exp 3	JPSP	B/A	adults	pinball	T	E	cont	attitude	26	26	+0.32

Vallerand, Reid (84)	J Sport Psych	B/A	adults	stabilo-meter	V	E	not	attitude	28	28	+0.53 [b]
Arnold (85)	Acad. Man. J.	B/A	adults	computer game	T	E	both	attitude	26	16	-0.04
Boggiano et al (85)	Social Cognition	A/O	children	puzzles	T	E	not	free time	26	13	-0.79
"	"	"	"	"	T	E	cont	free time	26	13	-0.10
Freedman, Phillips (85)	Org Beh & Hum Dec P	A/O	adults	proof reading	T	E	not	attitude	52	47	+0.75
"	"	"	"	"	T	E	cont	attitude	47	47	+0.68
Tripathi, Agarwal (85)	Psych Studies	A/O	adults	puzzles	T	E	not	free time	20	20	+0.41
"	"	"	"	"	"	"	"	attitude	20	20	+0.54
"	"	"	"	"	V	E	not	free time	20	20	+1.61
"	"	"	"	"	"	"	"	attitude	20	20	+0.48
Sansone (86) Exp 1	JPSP	A/O	adults	identify names	V	U	cont	attitude	44	11	+0.68
Amabile et al (86) Exp 1	JPSP	A/O	children	3 tasks	T	E	not	free time	56	57	0.00 [a]
"	"	"	"	"	"	"	"	attitude	56	57	0.00 [a]
Amabile et al (86) Exp 3	JPSP	A/O	adults	3 tasks	T	E	not	attitude	30	30	0.00 [a]
Harackiewicz et al (87)	JPSP	A/O	16 yr olds	puzzles	T	E	cont	attitude	24	27	-0.10

Hom (87) Exp 1	Pers & Soc Psych Bull	A/O	adults	pursuit rotor task	T	?	not	free time	26	26	+0.11[b]
"	"	"	"	"	"	"	"	attitude	26	26	0.00[a]
Fabes (87) Exp 1	J of Psych	A/O	children	block building	T	E	not	free time	18	19	-0.82
"	"	"	"	"	T	E	cont	free time	19	19	-0.87
Fabes (87) Exp 2	J of Psych	A/O	children	block building	T	E	not	free time	14	14	-0.45
Koestner et al (87)	JPSP	A/O	adults	hidden puzzles	V	U	not	free time	35	18	+0.51
"	"	"	"	"	"	"	"	attitude	35	18	0.00[a]
Butler (87)	J Ed Psych	A/O	children	problem solving	V	U	not	attitude	50	50	+1.59
Tripathi, Agarwal (88)	J Gen Psych	A/O	adults	problem solving	T	E	not	free time	20	10	+0.03
"	"	"	"	"	T	E	cont	free time	20	10	+1.18
"	"	"	"	"	T	E	both	attitude	40	10	+0.26[b]
Fabes et al (88)	Mot & Emotion	A/O	children	beanbag game	T	E	not	free time	14	14	-1.34
Sansone (89)	J Exp Soc Psych	A/O	adults	identify names	V	U	not	attitude	82	41	+0.46
Sansone et al (89)	JPSP	A/O	adults	computer games	V	U	not	attitude	40	40	+0.12

Anderson, Rodin (89)	J App Soc Psych	A/O	adults	brain teasers	V	U	not	attitude	10	10	+0.90
Mawhinney et al (89)	J Org Beh Manage-ment	SS repeated measures	adults	video game	T	E	not	time	3	—	+0.15
Wicker et al (90)	J of Psych	A/O	adults	Think Tac Toe	T	E	not	free time	29	29	0.00 [a]
"	"	"	"	"	"	"	"	attitude	29	29	0.00 [a]

Note.
Design: B/A = before/after groups design, A/O = after only groups design, SS = single subject design
Reward type: T = tangible, V = verbal
Reward expectancy: E = expected, U = unexpected
Reward contingency: cont = contingent, not=not contingent
[a] indicates effect sizes given a value of zero (non significant results with no report of means or direction of means)
[b] indicates estimated effect sizes

Journal:
JPSP = Journal of Personality and Social Psychology
J of Pers = Journal of Personality
Org Beh & Hum Perf = Organizational Behavior and Human Performance
J Exp Soc Psych = Journal of Experimental Social Psychology
Child Dev = Child Development
Per & Soc Psy Bull = Personality and Social Psychology Bulletin
Cog Ther & Res = Cognitive Therapy and Research
Mot & Emotion = Motivation and Emotion
Int J of Sport Psy = International Journal of Sport Psychology
J of School Psych = Journal of School Psychology
J Applied Soc Psych = Journal of Applied Social Psychology

Behavior Mod = Behavior Modification
Soc Beh & Pers = Social Behavior and Personality
J of Soc Psych = Journal of Social Psychology
J Applied Psych = Journal of Applied Psychology
J of Res Pers = Journal of Research in Personality
J General Psych = Journal of General Psychology
J Management = Journal of Management
Aust & N.Z. J Dev Dis = Australia and New Zealand Journal of Developmental Disabilities
J Sport Psych = Journal of Sport Psychology
Bull Psych Society = Bulletin of the Psychonomic Society
Br J Dev Psych = British Journal of Developmental Psychology
J Exp Psych = Journal of Experimental Psychology
Acad Man J = Academy of Management Journal
Org Beh & Hum Dec P = Organizational Behavior and Human Decision Processes
Psych Studies = Psychological Studies
J Org Beh Management = Journal of Organizational Behavior Management

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IV. A Socio-historic Review of the Literature

Since Deci's publication in 1971, hundreds of articles have been written about the negative impact of reward/reinforcement on intrinsic motivation. The previous literature review and meta-analysis however, suggest that reinforcement does not produce negative results and that rewards are detrimental only under a highly specified set of circumstances. Furthermore, this tightly circumscribed negative effect appears to be minimal. Why then have millions of dollars and thousands of human hours been spent on this question? A possible answer may lie in a consideration of the social and historical events that led to this research. In this chapter, an analysis of the social and historical context that gave rise to the literature on intrinsic motivation is presented.

In any historical account, the writer chooses the facts, events, concepts, and people to discuss and interpret. This, of course, leads to the inclusion of certain ideas and issues and to the exclusion of others. For this reason, many historians (e.g., Leahey, 1987) suggest that authors clearly state their point of view on a particular topic. The contention presented here is that the literature on intrinsic motivation came about because it offered the possibility of an empirical attack on reinforcement theory. Results from studies investigating the effects of reward/reinforcement on intrinsic motivation have predominantly been construed as evidence for weaknesses and limitations in reinforcement theory. Since reinforcement theory is strongly identified with behavioral views, the so-called negative effects of reward have been extended to behavioral theory in general.

This chapter begins with a description of some of the criticisms expressed by those who regard the research findings on intrinsic motivation as problematic for reinforcement theory, behavior modification programs, and behavioral approaches in general. Counter-arguments put forth by behaviorally-oriented researchers are also

discussed. Following this, trends and major personalities that have led to the proliferation and interpretation of the literature on intrinsic motivation are analyzed.

The Intrinsic Motivation Literature as an Attack on Reinforcement Theory and Practice

The first studies published on the impact of rewards on intrinsic motivation appeared in the early 1970's. From the beginning, results of such studies were not clear cut. The original experiment (Deci, 1971), that is often cited as showing the negative effects of tangible reward,was not significant at the 0.05 level. Additionally, verbal rewards were found to enhance intrinsic motivation. Other research findings indicated that tangible rewards produced decrements in intrinsic motivation under some circumstances and increments under others (e.g., Lepper, Greene & Nisbett, 1973). Although the early findings were conflicting, they were frequently interpreted (and continue to be interpreted) as demonstrations of the negative impact of reinforcement. Numerous statements appeared in the psychological and educational literature warning practitioners of the dangers of behavioral programs based on reinforcement principles and of the limitations of behavioral theories.

By the 1970's, dozens of behavioral programs based on principles of reinforcement had been set up in educational settings, hospitals, and the workplace. An extensive literature documented the beneficial outcomes of such programs (e.g., Ayllon & Azrin, 1968; Kazdin, 1975a, 1975b; Kazdin & Bootzin, 1972). One issue of concern was whether or not gains made in the treatment settings would generalize to non-treatment environments (Carlson, Hersen & Eisler, 1972; Kazdin, 1975a). Research findings on the effects of reward on intrinsic motivation were seen by many as directly relevant to this issue. In a 1974 *American Psychologist* article, Levine and Fasnacht suggested that token economy programs may be worse than ineffective. Drawing on the results of studies by Deci and others, Levine and Fasnacht (1974)

argued that "since tokens tend to decrease the intrinsic value of an activity, they may actually do more harm than good" (p. 819). They further stated that "the time has come for us to avoid a narrow operant perspective. Operant procedures have their place and their dangers" (p. 819). Such comments and cautions have been echoed throughout psychology and education ever since.

By 1975, leading introductory psychology textbooks included sections that related the findings from studies on intrinsic motivation to limitations in reinforcement theory and practice. For example, Zimbardo and Ruch (1975) stated that

> " the detrimental effect whereby extrinsic reinforcement transforms intrinsically motivated children into free enterprise entrepreneurs points up an important limitation to the laws of reinforcement...: even positive reinforcement may be counterproductive in its effect on the emission of behaviors that would have been practiced and enjoyed for their own sakes" (p. 568).

Some reviewers (e.g., Bates, 1979; Morgan, 1984; Notz, 1975) noted the contradictory nature of the research findings and concluded that few generalizations could be made about the negative effects of reward/reinforcement. Other writers, however, threw caution to the wind and interpreted results as a "crack in the wall of reinforcement theory and token economy technology" (deCharms & Muir, 1978; p. 104). In 1978, Lepper and Greene edited a volume entitled *The Hidden Costs of Reward*. Several contributors to the book suggested that the results from studies on intrinsic motivation reflected a failure of reinforcement theory and operant psychology. To illustrate, McCullers (1978) claimed that in Skinner's writings, reinforcement and reward are equated. He suggested that for Skinner "reinforcers (positive reinforcers) are simply rewards" (p. 12). Further, McCullers stated that

> "By equating positive reinforcement with a strengthening process, Skinner has ensured that rewards - by definition - can have only one effect, and that is to enhance behavior. The more frequently a reward is dispensed, the greater the response probability ..." (p. 13).

Based on this premise and the view that the studies to date had shown a negative effect of reward, McCullers concluded that reinforcement theory must be false. He contended that the work of Skinner and his followers may have blinded us to the "rather significant hidden costs" of reward (for a critique of this position, see Flora, 1990).

Later articles on the topic reflect similar sentiments. Lepper and Gilovich (1981) argued that the findings that extrinsic rewards undermine intrinsic interest was (and is)

> "inconsistent with the well-established findings that contingent reinforcement will increase the probability of the response it follows - the fundamental law of effect" (p. 6).

Vasta (1981) suggested that "the undermining phenomena ... would appear to warrant the respect of the behavioral community" (p. 138). Deci and Ryan (1985) stated that the findings from the intrinsic motivation studies "call into question several important foundations of operant psychology" (p. 182). Coming from a slightly different perspective, Schwartz (1990) has acknowledged the power of operant principles and contingencies of reinforcement but suggests that the experiments on intrinsic motivation indicate that "reinforcement can usurp control of an activity from other sources" (p. 11). Such laboratory demonstrations are seen as examples of "how value can be destroyed" (Schwartz, 1990; p. 11). These statements provide a few examples to illustrate how the results from studies on intrinsic motivation have been used to discredit behavioral views and practices.

In reaction to these attacks, several behaviorally-oriented researchers have attempted to refute the assertion that reinforcement produces harmful effects. A few studies were conducted in which no evidence of the undermining effects of reinforcement was apparent (e.g., Feingold & Mahoney, 1975; Davidson & Bucher, 1978). These studies were designed in the operant tradition (i.e., single-subject, repeated measures designs). For this reason, many critics of operant methodology

have ignored the findings. Others suggested that the generalizability of results of such studies is limited since few subjects participated and a non-rewarded control group was absent (e.g., Deci & Ryan, 1985). Thus, results from the single-subject designs are rarely brought up in discussions about the negative effects of reward/reinforcement.

In further defense of reinforcement theory and practice, some psychologists have registered objections to the basic notion of intrinsic motivation. They argue that the concept is unsatisfactory (e.g., Blocker & Edwards, 1982; Guzzo, 1979; Scott, 1975). For example, Flora (1990) suggested that "'intrinsic interest' and its supposed 'undermining' are hypothetical inventions that forestall scientific progress" (p. 324).

In a review article on the effects of reinforcement on intrinsic motivation, Dickinson (1989) noted that a common problem in the intrinsic motivation literature has been that many researchers consider 'reward' and 'reinforcement' to be synonymous (see quote from McCullers, 1978). She pointed out that in behavioral psychology, "the term *reinforcer* refers only to a stimulus change that *increases the frequency* of the behavior it follows" (p.10). In many of the studies on intrinsic motivation, the rewards used have not been shown to increase the frequency of task behavior. Thus, demonstrations of negative effects are seen as the result of reward, not reinforcement, procedures. Based on this contention, Dickinson, offered a behavioral account of the negative effects of 'reward'.

The literature on intrinsic motivation has triggered much dispute. In spite of the fact that results from studies on the effects of reward on intrinsic motivation do not support the contention that reinforcement is harmful, many psychologists have used the findings to discredit reinforcement theory. Additionally, counter-arguments to this position have largely been ignored. The overall message is that behavioral views are inadequate. This message has had (and continues to have) a powerful impact on psychology and on many realms of business and education. Although behavioral views had been criticized and debated for many years prior to the intrinsic motivation

literature, an experimental finding that suggested negative effects of reinforcement offered another avenue of attack. The beauty of this assault was that it was based on empirical findings and behavior analysis was an empirical science. Thus, behaviorists were hoisted on their own empirical petard.

In order to understand why such weak findings were so readily taken to mean a rejection of behavioral techniques and views, it is important to place the intrinsic motivation literature in its historical context. In the next section of this chapter, the rise of behaviorism in North American psychology is documented. Next, events in the 1950's which were directly related to the research generated on intrinsic motivation are presented. Finally, the literature on intrinsic motivation and its interpretations are seen within the context of rivalry between cognitive and behavioral orientations in psychology, and a concern with humans as autonomous and self-determining.

The Rise of Behaviorism in North American Psychology

The most commonly accepted date of origin of psychology as a science is 1879 when Wilhelm Wundt founded the first psychological laboratory. In its beginnings, psychology was the study of mental life; the aim was to describe and explain consciousness. Psychologists relied on introspection and self-observation as the key to understanding consciousness. These methods involved analyzing the contents of consciousness into component parts such as sensations, images, and feelings.

The move away from mentalism to psychology as the science of behavior began primarily in North America in the 1890's. In 1892, the American Psychological Association (APA) was founded. Professionalism brought with it a need to define the field of psychology and its members, and to play a role in society. By the late 1890's, "reform, efficiency, and progress' represented major values of American society. Leahey (1987) has referred to this period as "the 'age of the news' - the new education, the new ethics, the new woman, and the new psychology" (p. 262). Cattell (1896)

described the new psychology as quantitative and experimental and claimed "wide reaching practical applications in education, medicine, the fine arts, political economy, and indeed, in the whole conduct of life" (cited in Leahey, 1987; p 262). John Dewey, philosopher of progressivism and elected president of the APA in 1899, saw educational reform as a central concern for psychologists. If psychologists were to play a role in the broader society, they would have to understand how behavior is (and can be) controlled and the relationship between behavior change and environmental circumstances. This trend toward applied psychology would eventually lead psychologists to give up introspection and the study of consciousness in favor of the study of behavior.

In step with the times, William James argued for a practical psychology that would make a difference to the way people acted and lived. James's functional psychology focused not on the contents of the mind, but on how the mind worked to adapt to a changing environment. Thus, for James, the subject matter in psychology was still consciousness, but the focus shifted from mental content to mental function. Interestingly, this emphasis on functionalism led many experimental psychologists to an interest in stimulus-response relationships. At that time, psychological experiments were typically conducted by presenting a stimulus to a subject who would respond in some way, and at the same time report his/her experience. Several researchers began to turn away from these introspective reports and instead recorded correlations between stimuli and responses (e.g., Angell, 1903; Bryan & Harter, 1897). This was because introspection started to be seen as a method that would reveal what was, rather than what is to be, and hence, was not seen to be in accord with a functionalist perspective.

In animal psychology, similar events were taking place. Up to this time, animal psychologists primarily relied on drawing inferences from anecdotal evidence. By the late 1800's and the early part of this century, these methods appeared unsatisfactory. In their place, several researchers set up animal laboratories and conducted formal

experiments. Two such researchers who figure prominently in an historical account of the rise of behaviorism were Thorndike and Pavlov.

Thorndike (1911) was interested in studying adaptive behavior in animals, behavior often described as 'voluntary'. He conducted numerous laboratory experiments on cats, dogs, and chicks. Several experiments involved observing animals escape from puzzle boxes. Food was placed outside of the box and escape behavior such as pulling a string, stepping on a treadle, prying open a lock, and so on, was studied. Thorndike found that after repeated trials, the animals took less and less time to escape from the box. From these observations, he concluded that past successful results were important in determining present behavior and that this principle generalized across species. Thorndike proposed the 'law of effect' to account for the ability of past effects to modify current behavior patterns. The law of effect survives today as a fundamental principle in the analysis of behavior. Although Thorndike's contributions have had a profound impact on the subsequent development of behavioral approaches in psychology, his own interest as a psychologist went along with the concerns of the times; that is -- mental processes. Thorndike claimed that the effects (the escape behavior of the animal) were influential because they resulted in pleasure or satisfaction for the animal. These mental states were seen as the true causes of behavior. Thus, for Thorndike, the study of behavior was important because it revealed underlying mental processes and associations of ideas.

The other person whose ideas were highly influential in behavioral psychology was Ivan Pavlov. Pavlov, a Russian physiologist, was well known at the time for his work on digestion. In the course of his experiments on digestive secretions in dogs, Pavlov noticed that when the experimenter appeared, the dog would salivate, seemingly, in anticipation of food. This was an interesting observation. The appearance of the experimenter had not originally elicited salivation. The effect was observed only after the experimenter's appearance had been frequently associated with

the presentation of food. Taking advantage of this observation, Pavlov set out to experimentally investigate this phenomenon. His well known experiment involved ringing a bell prior to the presentation of food. After several pairings of the bell with the food, the bell alone came to elicit the response -- salivation. This phenomenon has come to be known as classical, reflexive, Pavlovian, or respondent conditioning. When a neutral stimulus (e.g., bell) is paired with an unconditioned stimulus (e.g., food), it becomes a conditioned stimulus capable of eliciting a conditioned response (e.g., salivation). Pavlov's contribution was to show how conditioned reflexes could be acquired, how they could be removed, and what range of stimuli was effective in their production. Although his interest was in the relationship of responses to the environment, Pavlov, like Thorndike, explained his findings in terms of underlying processes. For Pavlov, conditioning was to be understood in terms of brain functions.

Even though Thorndike and Pavlov's innovations were to be extremely important to behavioral psychology and in spite of the growing interest in behavior and environment relationships, it is John B. Watson who is credited as the founder of behaviorism as a school of psychology. In 1913, Watson delivered a lecture entitled "Psychology as the behaviorist views it" which was later published in *Psychological Review*. Watson argued for a science of observable physical events and behavior. He ruled out introspection as a legitimate activity and rejected any attempt to study thinking, the mind, or any other phenomena that could not be directly observed. Psychology was to be defined as the science of behavior, its goal would be to describe, predict, and control observable behavior. Watson's paper was a call for psychologists to throw away their allegiance to mentalistic psychology. In his later writings, Watson suggested that the study of consciousness was analogous to clinging to religion in an age when science had made religion obsolete. He thus, contended that psychologists should discard any references to consciousness.

Watson's behaviorism was based on Pavlov's classical conditioning. He extended Pavlov's ideas and suggested that classical conditioning could account for complex human behavior and learning. In his classic experiment with Raynor (Watson & Raynor, 1920), Watson conditioned an emotional fearful reaction in an infant boy named Albert. Albert was placed in a room with a white laboratory rat. When Albert approached the rat, the researchers sneaked up behind him and produced a loud, startling noise. After several trials, Albert became fearful of the rat. Here was a case of classical conditioning. The neutral stimulus (the rat) had become a conditioned stimulus that could then elicit a conditioned response (fear). From this experiment and logical argument, Watson contended that much human behavior could be accounted for by classical conditioning. He even went so far as to claim that 'thinking' was nothing more than sub-vocal speech. In a now famous statement, Watson (1924) suggested that he could take any healthy child and by arranging the environment in a particular way he could make that child into

> "...any type of specialist I might select - doctor, lawyer, artist, merchant chief, and yes, even beggar and thief, regardless of [the child's] talents, penchants, tendencies, abilities, vocations and race of his ancestors" (p. 104).

Following Watson, the study of behavior became a major focus. After World War I, behaviorism established itself as the dominant school in North American psychology. Although this occurred, several critics remained committed to a psychology of consciousness and mental processes. As well, behavioral psychology itself was not uniform. Most psychologists began to refer to themselves as behaviorists, but behaviorism was to take many forms. Importantly, some forms of behaviorism have led directly to what is known today as 'cognitive science'.

At that time, any conception of stimulus-response relations was called behavioral. Many of these conceptions were based on hypothetical mental constructs, intervening variables, and an organism's anticipation of its consequences of behavior.

Out of such conceptions, a number of prominent individuals constructed elaborate models of behavior and learning. This period of construction of theories and models which occurred in the 1930's and 1940's has often been described as the age of the great learning theorists.

The Age of the Great Learning Theorists

The next major development with regard to behaviorism was the rise of what some have called the great learning theorists. Hull, Guthrie, Tolman, Spence, Estes, Skinner and others all proposed grand theories in an attempt to explain and predict behavior. By 1943, three major behavioral books had appeared: Tolman's (1932) *Purposive Behavior in Animals and Men*, Skinner's (1938) *The Behavior of Organisms*, and Hull's (1943) *Principles of Behavior*. Each of these authors attempted to clarify what a behavioral approach to psychology was and to define a methodology for discovering and formulating laws of behavior. Interestingly, at the time, Skinner's influence was minimal (see Leahey, 1987). Eventually, however, Skinner's behaviorism would come to replace all other behaviorisms, while the ideas of Tolman and Hull were to serve as a precursor to many of the cognitive concepts used today. Tolman and Hull's theories are briefly described here as they relate to the rise of cognitive psychology. In addition, Skinner's position is outlined since it set the stage for what is known as 'radical behaviorism' today and became the source of much debate and confusion.

Tolman's purposive behaviorism suggested a forward thinking organism that anticipated the consequences of its behavior. He spoke of cognitions and thoughts as internal representations that play a causal role in determining behavior. For Tolman, B = f(E, I), where behavior (B) was a function (f) of environment (E) and individual variables (I). Individual variables were intervening variables or hypothetical constructs that resided within the organism and accounted for variation in behavior.

Clark Hull's mechanistic behaviorism differed from Tolman's in that purpose and intention were not explanatory mechanisms. The behavior of organisms was due to environmental variables that affected the organism which, in turn, generated behavior. Hull saw mental events as the outcome of mechanistic, lawful principles of behavior. Animals did not behave purposefully, they only appeared to do so. Both Hull and Tolman shared a conception of behavior that is best described as an S - O - R theory. In this paradigm, external stimuli impinge on the organism, the organism in some way internally responds, and then acts accordingly. Where Hull and Tolman differed was in what happens inside the organism.

The major exception to the S - O - R paradigm was proposed by B.F. Skinner (1938). Skinner's approach to psychology was not based on an S - O - R model, nor was it Watson's methodological behaviorism (S - R). Skinner distinguished two kinds of learned behavior: respondent and operant. Respondent behavior and learning, which had been studied by Pavlov, refer to reflexive behavior *elicited* by conditioned or unconditioned stimuli. Operant behavior, which corresponds to voluntary behavior (called 'instrumental' by Thorndike), is not elicited; it is *emitted* from time to time. The probability of occurrence of operant behavior may be raised when it is followed by reinforcement; after reinforcement the operant will be more likely to occur again in similar settings. Skinner revised Thorndike's law of effect by removing references to satisfaction and pleasure. Instead, a reinforcer was defined as any stimulus which when it followed behavior increased the frequency of that behavior.

Skinner has suggested that an analysis of operant behavior involves a consideration of a prior learning history and of the contingencies of reinforcement, the S^D: R -> S^r relationship (i.e., the setting event, the response and the consequences). For Skinner, the influence of mental events explains nothing that cannot be explained by referring current behavior to the consequences of past behavior. In Skinner's behavior analysis, thoughts, feelings, and so on are not denied. Thinking, feeling,

perceiving, etc. are understood as more behavior under the control of contingencies of reinforcement. Within this framework, the central concerns of psychology become, at least theoretically, amenable to a behavior analysis. According to Skinner, contingencies of reinforcement are central to an understanding of human thinking, feeling, and other behavior.

Skinner's behaviorism has been called 'radical behaviorism' in order to distinguish it from other behavioristic epistemologies. Radical behaviorism differs from other behaviorisms in a number of ways. For one, the mode of causation of behavior is analyzed in a Darwinian fashion. In evolutionary biology, characteristics that are adaptive are selected and passed on to the next generation. Similarly, Skinner (1987) contends that principles of selection are the causative factors that govern the behavior of organisms. Reinforcement from the environment follows some operants and not others. Behavior that is reinforced is strengthened, behavior that is not, is extinguished. From this perspective, behavior is a product of an individual's reinforcement history and genetic make-up, not the result of mechanistic forces as suggested by an S - R account (e.g., Hull, Watson), nor the product of intention or will (e.g., Tolman).

Another way Skinner's behaviorism differed from other behavioral views is with respect to motivation. According to Hull, motivation was to be understood as a matter of drive reduction. Hull emphasized the role of tension in motivation and of tension reduction as a reinforcer. Skinner saw no reason for motivational theories. He suggested that postulated mental or physiological states such as 'drive' could be eliminated by linking deprivation states to behavior change (for an elaboration of this view, see Michael, 1982).

It should be clear from the above discussion that although behaviorism came to be the representative school of psychology in the 1930's and 40's, it was understood in many different ways. Most behaviorists went beyond Watson's methodological

behaviorism and many emphasized internal determinants of behavior. During the 1950's, these diverse views existed side by side in relative peace. Yet, it was events in the 1950's that were to lead to cognitive psychology and to a great deal of unrest between behaviorists and cognitivists.

Psychology in the 1950's

The 1950's has been described as a period of "comfortable eclectism" in psychology (Leahey, 1987; p. 371). Many varieties of behaviorism were being espoused throughout colleges and universities in North America. Three important developments in the 50's are described here as they are seen to have set the stage for the research on intrinsic motivation and its interpretations. First, the rise of cognitive psychology is outlined. Next, Skinner's views on freedom and control are discussed. Finally, Festinger's (1957) theory of cognitive dissonance which came from social psychology is described.

The rise of cognitive psychology is best understood as the culmination of a number of events. Followers of Hull and Tolman continued to be interested in mental events and the use of intervening variables and hypothetical constructs. Furthermore, as psychology expanded in the post-war years, many psychologists became interested in cognitive theories that had developed in Europe (e.g., Piaget's cognitive development theory). But, the final bridging link between an interest in mental events and the full development of cognitive psychology came from outside psychology -- from the work of Simon (1956), and Newell, Shaw, & Simon (1958) on computers and artificial intelligence. The advent of computers brought with it a new conception of humans as information processing machines and a new language for formulating theories about internal cognitive processes. Behaviorists of the Hull and Tolman persuasion were easily drawn to the computer analogy as they had already accepted the idea of internal processes intervening between S and R. 'S' and 'R' could now be

replaced with 'input' and 'output', and mediating events could be replaced with cognitive theories about internal computations. The goal of psychology would become the specification of how people process information and how their behavior is affected by these internal events (Leahey, 1987).

At the same time that a number of psychologists were turning to cognitive theories, Skinner began to extend radical behaviorism to account for many complex human behaviors (e.g., *Verbal Behavior*, 1957). One area that was later to become the focus of much debate concerned Skinner's views of freedom and control. In the spirit of Watson, Skinner argued that the goal of psychology was to describe, predict, and control behavior. The control of behavior is a pervasive theme that runs through much of Skinner's writings (e.g., Skinner, 1953, 1955-56, 1968, 1971). According to Skinner, behavior is controlled. One can either manipulate those environmental events that produce behavior or leave behavior to chance events. In either case, behavior is determined by environmental factors[1]. To Skinner, freedom is an illusion. The belief and desire for freedom are seen as a response to punishment. Skinner argues that historically, governments have controlled people through punitive measures. People seek to be free from (to avoid) punishment and the result is a belief in freedom. Given this view, Skinner proposed an informed technology of behavior, based on positive reinforcement; the goal -- to improve human life and create a world where people feel free and happy.

The third development in the 1950's that influenced research on the effects of rewards on intrinsic motivation came from studies conducted in social psychology. Social psychology had developed independently of behavioral and information processing accounts of behavior. Social psychologists had long been interested in studying attitudes and developing theories about how people form and integrate beliefs.

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[1] Modern radical behaviorists do not adhere to such a strict determinism (e.g., see Hoyert, 1992)

In the 1950's, Leon Festinger (1957) proposed the theory of cognitive dissonance which became highly influential in the 1960's. Cognitive dissonance theory postulated that if an individual's beliefs and behavior were inconsistent, the individual would experience an unpleasant feeling -- dissonance. The person would resolve the conflict by changing his/her beliefs in order that they were consistent with behavior.

In a study on cognitive dissonance conducted by Festinger and Carlsmith (1959), college students were asked to engage in a very boring task. They were then asked to lie to new subjects by telling them how interesting and exciting the task was. One group of subjects received $1.00 for telling the lie; another group received $20.00. Later, subjects were asked to describe their true feelings about the task. Cognitive dissonance theory predicted that those who were paid a lot of money would experience little dissonance (since their lying behavior was amply justified by the money) and would report that the task was boring. On the other hand, subjects who were paid little money would experience more dissonance and would seek to resolve the conflict by actually believing that the experimental task was not boring. In fact, this was what happened.

Cognitive dissonance theory generated a large body of research in the 1960's. The focus on the relationship between rewards and attitudes can be seen as directly related to the literature on the relationship between rewards and intrinsic motivation. In addition, several researchers interpreted findings from the cognitive dissonance literature as inconsistent with the law of effect (for a discussion of this issue, see Kruglanski, 1978). That is, some researchers suggested that the law of effect would predict that $20.00 would change one's report about the enjoyability of the task more than $1.00. Since this is not what happened, the law of effect was questioned (although, see Bem, 1967, who reinterpreted the results from a behavioral perspective).

These three developments: the growth of cognitive psychology; a general distaste for Skinner's view of freedom, control, and technology; and the research on cognitive dissonance; which all began in the 1950's, set the context for the research on intrinsic motivation.

The Intrinsic Motivation Literature in Context

By the 1960's and 1970's, both cognitive psychology and radical behaviorism were established schools within psychology. Radical behaviorists emphasized the importance of behavior/environment relationships; cognitivists attended to internal processes and mental events within the individual. This difference in focus led advocates from the two camps to debate and criticize each others positions. In addition, Skinner's strict determinism and his emphasis on control roused a great deal of controversy. It ran contrary to the basic belief in free will that is held by most North Americans and led several psychologists to put forth a position of humans as willful and self-determining. It was during this period of rivalry and unrest that the research on the effects of reward/reinforcement on intrinsic motivation was instigated.

Cognitive science gained numerous supporters in the 60's and 70's. Since radical behaviorism represented the only major behavioral influence in psychology, Skinner and his followers were to come under increasing attack. Many of the criticisms were based on misconceptions about radical behaviorism. One would often hear behaviorism described as a mechanistic, S-R account of humans that did not consider genetic determinants of behavior. Behaviorists were accused of representing people as non-thinking, non-feeling, automatons (as an aside, it is interesting to point out that it is cognitive psychologists who view humans as machines, not radical behaviorists). As Catania (1984) put it

> "Of all the contemporary psychologists, B.F Skinner is perhaps the most honored and the most maligned, the most widely recognized and the most

> misrepresented, the most cited and the most misunderstood. Some still say that he is a stimulus-response psychologist (he is not); some still say that stimulus-response chains play a central role in his treatment of verbal behavior (they do not); some still say that he disavows evolutionary determinants of behavior (he does not). These and other misconceptions are common...."(p. 473)

Rachlin (1984) has suggested that Skinner's views have been largely misunderstood because people think that mentalistic vocabulary is forbidden to the behaviorist. He points out that the critical difference between a behaviorist and a mentalist is the point at which explanation stops. The radical behaviorist explains behavior (and mental states) as the result of past external behavior/environment interactions. The cognitivist infers mental events (perceptions, beliefs, expectancies) as the causal focus of current behavior.

As well as the numerous misunderstandings that are sprinkled throughout the psychological literature, serious arguments were also directed at radical behaviorism. Several writers (e.g., Wessels, 1981) could not accept Skinner's rejection of mentalistic theories, statistical analyses, hypothesis testing, and inferred processes, and argued that inferred processes, etc. have played a major role in other sciences. Schwartz, Schuldenfrei and Lacey (1978) maintain that behaviorism has restricted explanatory power. They see no evidence that behavior principles operate outside closed settings and argue for an explanatory scheme with origins in practical life. The attacks and criticisms of radical behaviorism have, of course, not gone undefended, nor in many cases have they been unprovoked (e.g., see Skinner, 1974; 1978).

Perhaps the issue that created the most furor concerned Skinner's position with regard to freedom, control, and technology. Many could simply not accept a view of humans as controlled (e.g., see Krutch, 1953), nor could they accept the consequences of determinism. "To accept a rigorous determinism and apply it to one's own behavior is extremely difficult, requiring the overthrow of a lifetime's habits of thought" (Leahey, 1987; p.461). Instead, some psychologists stressed the notion of "personal causation" (deCharms, 1968) and argued that humans are goal directed, self-

determining, free agents (e.g., Deci, 1975). With regard to Skinner's proposal for a technology of behavior, Laurence Smith (1992) has contended that following World War II, people became suspicious and skeptical "about the prospects for solving technologically generated problems with further technology of any sort" (p. 221).

Amidst the debates and the battles against radical behaviorism, Kuhn (1962, 1970) published *The Structure of Scientific Revolutions*. Put simply, Kuhn's thesis was that anomalies or problems periodically arise in a science and cannot be resolved under the prevailing paradigm. A revolution occurs when one paradigm is discarded in favor of another. Inevitably, such times are marked with debate and resistance to paradigm change. Kuhn's work received wide recognition. Psychologists in the 60's and 70's began to claim that a scientific revolution was taking place in psychology right under their noses (e.g., Palermo, 1971). The view was that behaviorism would be replaced by cognitive science. Over the years, several writers have argued that a cognitive revolution did, in fact, take place in the 60's (e.g., Baars, 1986). In 1977, MacKenzie declared behaviorism as dead (although see Zuriff, 1979, who pointed out that MacKenzie's conception of behaviorism was Hullian, not radical behaviorist).

Leahey (1992) has suggested that there never has been a cognitive revolution, that the idea was ignited in the 1960's and 1970's by Kuhn's publication itself. Kuhn's work served as a "rallying flag" (Peterson, 1981) for cognitivists. From this perspective, many of the criticisms aimed at behaviorism can be construed as resulting from a zeal for revolution spurred by a reading of Kuhn.

Psychology in the 1960's and 70's can be characterized as a period of turmoil. Many psychologists became convinced that cognitive processes and mental events should be the focus of their discipline. Given this view, they attempted to discredit behavioral views. Kuhn's work was often cited to support the cognitive position and to point the finger at radical behaviorists. Interestingly, at the same time that psychologists were attacking behavioral views and voicing their suspicions about

behavioral technology, the use of behavioral techniques was expanding in applied settings (e.g., classroom token economies and incentive systems). Thus, given the pervasive influence of cognitive psychology and the growing application of behavior modification techniques, the research examining the effects of reinforcement on intrinsic motivation was a timely and relevant consideration. As well, since most of the criticisms aimed at behaviorism were based on logical argument rather than experimental findings, the time was ripe to produce 'empirical' evidence that would demonstrate negative effects of reinforcement contingencies. Research findings that indicated detrimental effects would attack the very heart of behaviorism -- reinforcement -- and would have widespread implications for behavioral technology. It is within this context that the early studies by Deci (1971, 1972a, 1972b), and Lepper, Greene, and Nisbett (1973) were conducted and interpreted.

The research on intrinsic motivation came out of social psychology. Recall that cognitive dissonance theory was prominent in social psychology in the 60's. By the late 1960's, attribution theory (Kelly, 1967) and self-perception accounts of attitudes (Bem, 1972) were gaining popularity. Thus, social psychologists arrived at the topic of rewards and intrinsic motivation via an interest in attitudes that came from an attribution and self-perception perspective, via an interest in the relationship between attitudes and rewards as initiated by Festinger in the work on cognitive dissonance, and via an interest in discrediting reinforcement theory stemming from the zeitgeist of the 60's and 70's.

Summary and Conclusion

The thesis of this historical review is that the literature on the effects of reward/reinforcement started out as an empirical attack on reinforcement theory and practice. The first studies appeared in the early 1970's. This was a time when behaviorism was under fire. Cognitive psychology was becoming well-established and

many psychologists argued that internal states were direct causes of behavior, not reinforcement contingencies. Fueled by Kuhn's publications on scientific revolutions and a fear and suspicion of behavioral technology, many set out to to demonstrate the inadequacies of behavioral views. Coming out of concepts in social psychology and a general climate of dissatisfaction about behaviorism, studies on the effects of reward/reinforcement were generated.

Deci's initial studies established the research paradigm under which the negative effects of reward/reinforcement on intrinsic motivation were and continue to be investigated. Although Deci's findings were weak (i.e., the difference between rewarded and non-rewarded individuals on a subsequent measure of intrinsic motivation was $p > .05$), he argued that reinforcement did indeed produce decrements in intrinsic motivation. Given the prevailing cognitive orientation toward psychology, it is not surprising that Deci's claims were quickly seized upon and further investigations were conducted to confirm his conclusions. In addition, a number of psychologists began to issue warnings that Deci's demonstrations of the negative effects of reward directly contradicted reinforcement theory and had relevance to the use of incentive programs in schools and other institutional settings

The experiment by Lepper, Greene, and Nisbett (1973) is perhaps the most widely cited example of the detrimental effects of reinforcement. What is striking about this study is that only children who were promised a reward showed a decrease in intrinsic motivation relative to a control group. Children who received but were not promised a reward demonstrated an increase in intrinsic interest. Given these findings, a logical conclusion is that the promise, rather than the reward per se, may have produced the differences. Needless to say, the results have seldom, if ever, been interpreted this way. Instead, many psychologists have asserted that the Lepper et al study is yet another demonstration of the undermining effects of reinforcement

contingencies. In addition, in their enthusiasm to attack the general tenets of the behavioral position, many have mistakenly equated promised rewards with reinforcers.

Had these studies been conducted in another time or place, with different dominant psychological views, the findings may have been interpreted in a very different light.

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Appendix A

Formulas for Calculating Effect Size, g

1.

$$g = \frac{X_E - X_C}{S_p}$$

where

X_E = mean of experimental group
X_C = mean of control group
S_p = pooled standard deviation

$$S_p^2 = \frac{(n_E - 1)S_E^2 + (n_C - 1)S_C^2}{n_E + n_C - 2}$$

where

S_p^2 = pooled variance
S_E^2 = variance of experimental group
S_C^2 = variance of control group
n_E = sample size of experimental group
n_C = sample size of control group

2.

$$g = t\sqrt{\frac{2}{n}}$$

for equal n's; n=sample size of each group

3.

$$g = t\sqrt{\frac{1}{n_E} + \frac{1}{n_C}}$$

for unequal n's

4.

$$g = \sqrt{F}\sqrt{\frac{n_E + n_C}{n_E n_C}}$$

Appendix B

Analyses with zeros and outliers included

Free Time on Task

Reward Type	Expectancy	Contingency	k	Sample size	Mean weighted d	95% C.I for d	Q
Tangible	All	All	55	3302	-0.18	-0.25 to -0.11	183.82 *
Tangible	Expected	All	54	3144	-0.20	-0.27 to -0.13	189.02 *
Tangible	Expected	Non-contingent	43	2296	-0.24	-0.33 to -0.16	167.97 *

Attitude

Reward Type	Expectancy	Contingency	k	Sample size	Mean weighted d	95% C.I for d	Q
Verbal	All	All	18	1197	+0.38	0.26 to 0.50	76.40 *
Tangible	All	All	52	3525	+0.06	-0.01 to 0.13	144.76 *
Tangible	Expected	All	48	3174	+0.07	-0.01 0.14	136.95 *
Tangible	Expected	Contingent	26	1748	+0.16	0.07 to 0.26	94.02 *
Tangible	Expected	Non-contingent	26	1467	-0.02	-0.13 to 0.08	50.26 *

Note. Negative effect sizes indicate a decrease in intrinsic motivation for reward/reinforcement groups; positive effect sizes indicate an increase. k = number of effect sizes; Sample size = sum of n in all studies; Mean weighted d = mean of weighted effect sizes (weighted by sample size); C.I. = confidence interval; Q = homogeneity statistic for mean effect sizes, CL = common language effect size statistic.

* Significance indicates rejection of the hypothesis of homogeneity.

* $p < .01$

Appendix C

Additional Analyses

Two analyses were conducted to address the following questions:

1) What are the effects of expected tangible rewards on intrinsic motivation relative to unexpected tangible rewards?

2) What are the effects of expected tangible non-contingent rewards on intrinsic motivation relative to expected tangible contingent rewards?

These analyses involved direct comparisons between expected and unexpected reward groups and non-contingent and contingent reward groups. Studies selected for these analyses did not involve comparisons to a control group. In one analysis, 15 studies were included in which subjects who were promised a reward (expected reward) were compared to subjects who received an unexpected reward. Seven of these comparisons came from studies drawn from the original ninety five; 8 additional studies were located. Another analysis involved comparing subjects who received non-contingent rewards to those who received contingent rewards. Twenty-two studies were selected for this analysis; 13 came from the original sample of 95.

Results from comparisons between expected tangible reward and unexpected tangible reward groups

Free time

Analysis	k	Sample size	Mean weighted d	95% C.I. for d	Q*
All known effects (zeros excluded)	10	437	-0.26	-0.45 to -0.06	16.44
All reports (zeros and outliers included)	12	501	-0.22	-0.40 to -0.04	17.35

Attitude

Analysis	k	Sample size	Mean weighted d	95% C.I. for d	Q*
All known effects (zeros excluded)	5	254	-0.23	-0.48 to 0.02	6.92

Note. Negative effect sizes indicate a decrease in intrinsic motivation for reward/reinforcement groups; positive effect sizes indicate an increase. k = number of effect sizes; Sample size = sum of n in all studies; Mean weighted d = mean of weighted effect sizes (weighted by sample size); C.I. = confidence interval; Q = homogeneity statistic for mean effect sizes, CL = common language effect size statistic.

* Significance indicates rejection of the hypothesis of homogeneity.

* $p < .01$

Results from comparisons between expected tangible non-contingent reward and expected tangible contingent reward

Free time

Analysis	k	Sample size	Mean weighted d	95% C.I. for d	Q[a]
All known effect (zeros excluded	10	469	-0.10	-0.29 to 0.08	30.80 *
Outliers removed	8	381	-0.10	-0.31 to 0.10	14.83
All reports (zeros and outliers included)	11	533	-0.09	-0.26 to 0.08	30.96 *

Attitude

Analysis	k	Sample size	Mean weighted d	95% C.I. for d	Q[a]
All known effect (zeros excluded	13	647	+0.02	-0.14 to 0.17	14.64
All reports (zeros and outliers included)	17	943	+0.01	-0.12 to 0.14	14.65

Note. Negative effect sizes indicate a decrease in intrinsic motivation for reward/reinforcement groups; positive effect sizes indicate an increase. k = number of effect sizes; Sample size = sum of n in all studies; Mean weighted d = mean of weighted effect sizes (weighted by sample size); C.I. = confidence interval; Q = homogeneity statistic for mean effect sizes, CL = common language effect size statistic.

[a] Significance indicates rejection of the hypothesis of homogeneity.

* $p < .01$

Characteristics of Studies comparing expected tangible reward to unexpected tangible reward

Author(s)	Journal	Subjects	Task	Dep. measure	N Expected	N Unexpected	Effect size (g)[a,b]
Lepper et al (73)	JPSP	children	drawing	free time	18	18	-0.77
Greene, Lepper (74)	Child Dev	children	drawing	free time	26	30	-0.78
Lepper, Greene (75)	JPSP	children	puzzles	free time	40	40	-0.35
Enzle, Ross (78)	J Exp. Soc. Psych	adults	Soma-like task	attitude	48	24	-0.07
Orlick, Mosher	Int. J Sport Psych	children	stabilo-meter	free time	14	12	+0.48
Dollinger (79)	Cog. Ther & Research	children	puzzles	free time	15	16	-0.07
Malloy (79)	Mental Ret. Bull	children	drawing	free time	20	10	+0.49 [b]
Fazio (81)	J. Exp. Soc. Psych	children	drawing	free time	16	16	-0.69
"	"	"	"	attitude	16	16	+0.53
Pallack et al (82)	Child Dev	children	drawing	free time	15	15	+0.16
Pretty, Seligman (84) Exp 1	JPSP	adults	Soma	free time	30	30	-0.82
"	"	"	"	attitude	30	30	-0.47
Pretty, Seligman (84) Exp 2	JPSP	adults	Soma	free time	30	30	-0.18
"	"	"	"	attitude	30	30	-0.54
Harackiewicz et al (84)	JPSP	adults	pinball	attitude	15	15	-0.33
Scott, Miller (85) Exp. 1	J of Genetic Psych	children	mazes	free time	16	16	0.00 [a]
Scott, Miller (85) Exp 2	J of Genetic Psych	children	mazes	free time	16	16	0.00 [a]

Note. [a] indicates effect sizes given a value of zero (non significant results with no report of means or no report of direction of means), [b] indicates estimated effect sizes

Characteristics of studies comparing expected tangible non-contingent reward to expected tangible contingent reward

Author(s)	Journal	Subjects	Task	Dep. measure	N Expected	N Unexpected	Effect size (g)[ab]
Farr (76)	Org Beh & Hum Perf	adults	models	attitude	45	45	0.00 [a]
Pinder (76)	J of Applied Psych	adults	problem solving	attitude	40	40	+0.32
Karniol, Ross (77)	Child Dev	children	slide show game	free time	17	20	-0.18
Farr, Vance et al (77) Exp 1	Org Beh & Hum Perf	adults	Soma	free time	24	24	+0.68
"	"	"	"	attitude	24	24	-0.68
Farr, Vance et al (77) Exp 2	Org Beh & Hum Perf	adults	Soma	free time	32	32	0.00 [a]
"	"	"	"	attitude	32	32	0.00 [a]
Enzle, Ross (78)	J Exp. Soc. Psych	adults	Soma-like task	attitude	24	24	-0.19
Fisher (78)	Org Beh & Hum Perf	adults	puzzles	attitude	41	41	0.00 [a]
Weiner, Mander (78)	Mot & Emotion	adults	decoding cartoons	attitude	30	30	0.00 [a]
Harackiewicz (79)	JPSP	adults	hidden puzzles	attitude	16	31	+0.36
Wimperis, Farr (79)	J Applied Soc Psych	adults	erector sets	attitude	16	16	-0.81
Phillips, Lord (80)	J Applied Psych	adults	computer game	free time	28	28	-0.24
"	"	"	"	attitude	28	28	-0.04
Rosenfield et al (80)	JPSP	adults	Ad Lib	free time	29	30	+0.63
"	"	"	"	attitude	29	30	+0.23
Luyten, Lens (81)	Mot. & Emotion	adults	models	free time	10	10	-0.05
"	"	"	"	attitude	10	10	-0.96
Pittman et al (82)	JPSP	children	matching	attitude	10	10	-0.12

Agarwal, Tripathi (84)	Psychologia	adults	proof reading	free time	40	40	+0.02
"	"	"	"	attitude	40	40	+0.22
Arnold (85)	Acad. Man J	adults	computer game	attitude	13	13	+0.02
Boggiano et al (85)	Social Cognition	children	mazes	free time	26	26	-0.69
Freedman, Phillips (85)	Org Beh & Hum Perf	adults	proof-reading	attitude	52	47	+0.07
Fabes (87), Exp 1	J of Psych	children	block building	free time	18	19	+0.05
Tripathi, Agarwal (88)	J Gen. Psych	adults	problem solving	free time	20	20	-1.16 [b]
"	"	"	"	attitude	20	20	-0.11 [b]
Tripathi (91)	J Gen Psych	adults	puzzles	free time	20	20	-0.63 [b]
"	"	"	"	attitude	20	20	-0.23 [b]

Note: Note. [a] indicates effect sizes given a value of zero (non significant results with no report of means or direction of means), [b] indicates estimated effect sizes

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